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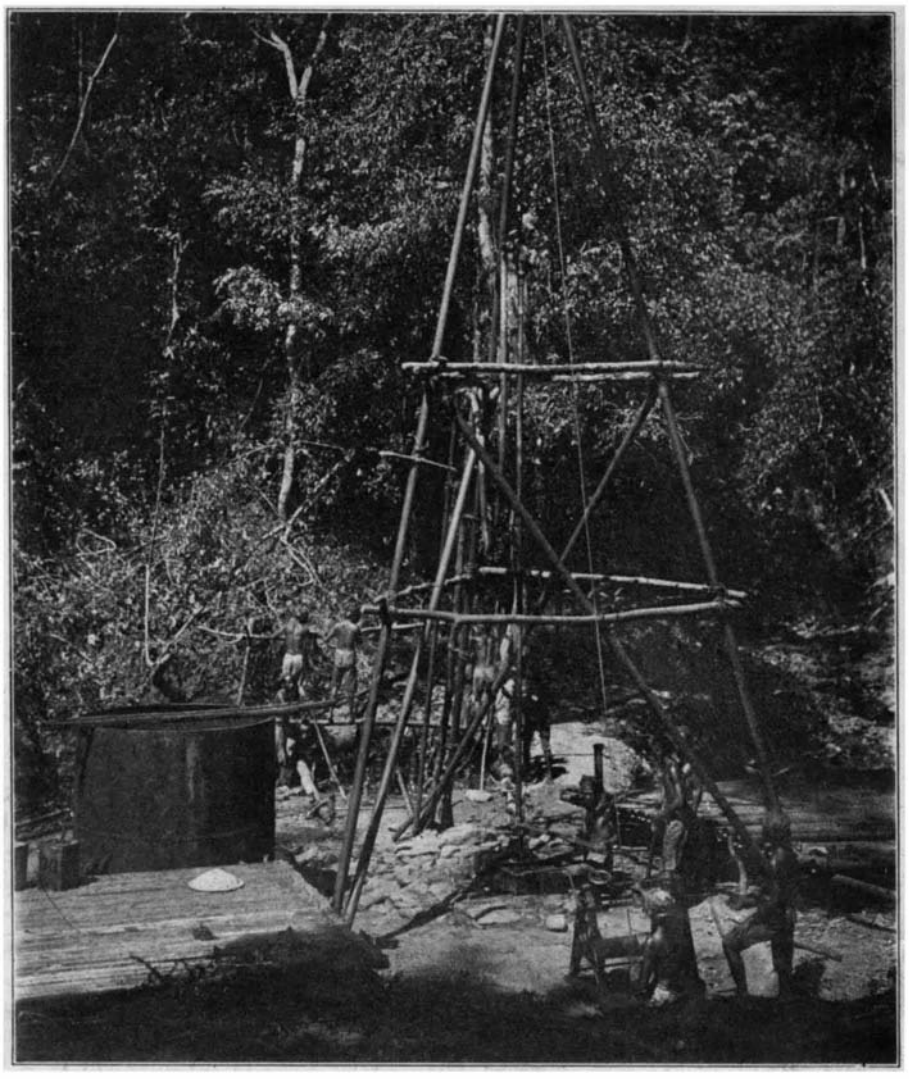
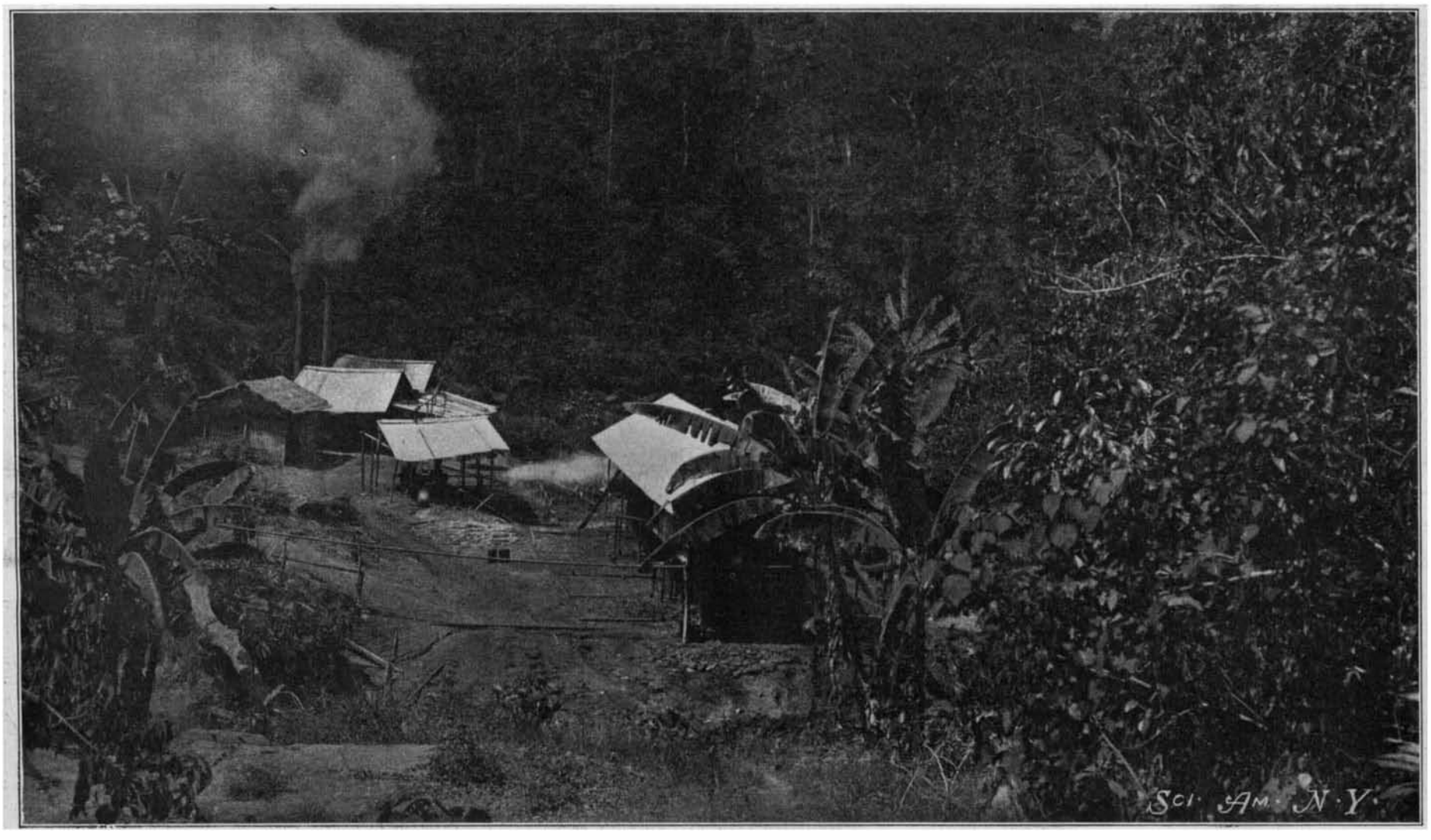
Boring an Artesian Well to Obtain Flushing-Water for the Oil Wells.



The Oil Derrick in the Heart of the Jungle.



Pumping Station and Oil Tanks in the Jungles of Java.

THE OIL FIELDS OF JAVA.—[See page 259.]

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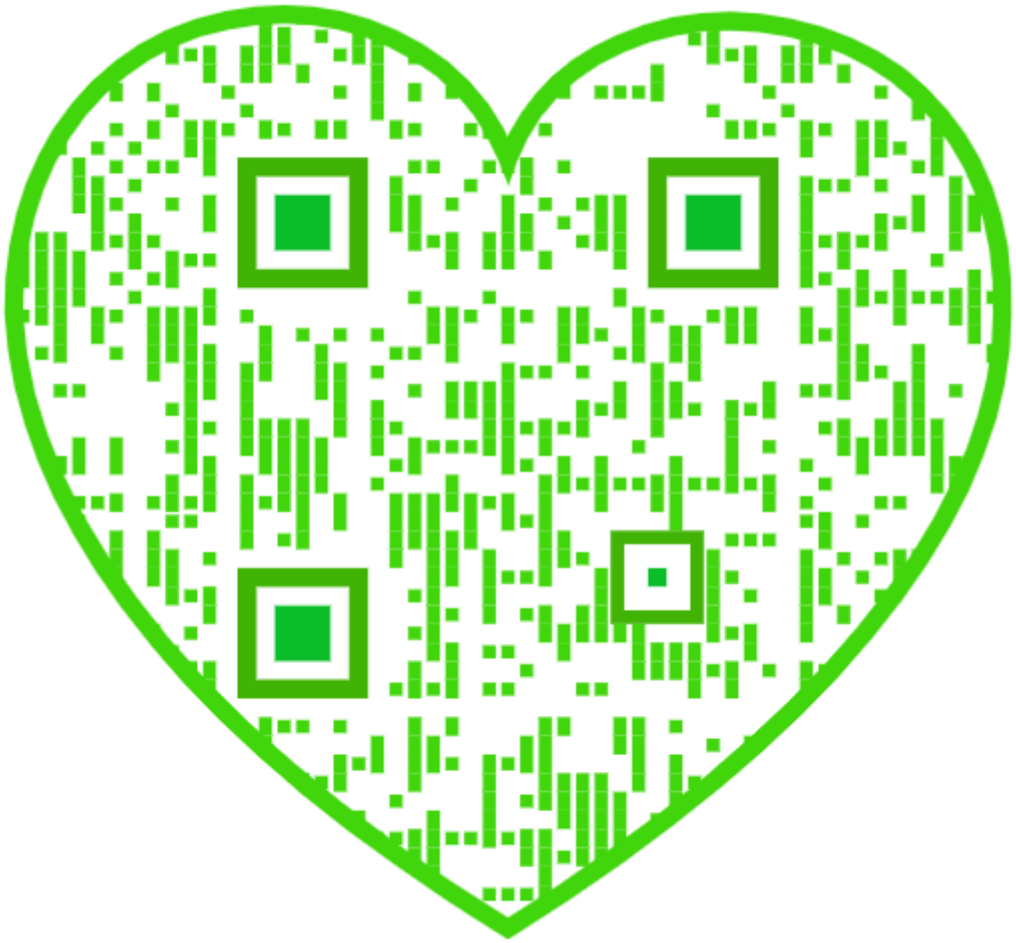

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NEW YORK, SATURDAY, OCTOBER 10, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE DOUBLE-DECK CAR FOR RAPID TRANSIT.

Of the many schemes suggested for the improvement of rapid transit facilities in the congested centers of our larger cities, the one which above all others would give the greatest relief is the least known and the least talked about. We refer to the double-deck car. Many times during the past few years the SCIENTIFIC AMERICAN has drawn attention to this simple and ready method of doubling the capacity of any given line of railroad, and we have earnestly recommended its adoption on the crowded surface lines of New York city. We remember that when, in 1897, during the course of conversation with Mr. Vreeland, at that time president of the Metropolitan Street Traction Company, we suggested that the quickest way to increase the capacity of his roads, and more particularly of the Broadway line, would be to double-deck the cars, he replied that double-decking would afford no relief, and might prove to be a positive hindrance. The theory advanced was that when cars are running under ten seconds headway, the frequency of the service is dependent primarily upon the speed with which they can be loaded and unloaded, or upon the shortness of stops; and that doubling the capacity of each car would simply produce a congestion at the platforms that would lengthen the stops and so reduce the capacity of the line.

In spite of this opinion from one of the leading authorities on street railway traveling, the double-deck car has continued to multiply and prove its usefulness, where it has been given a trial, to such an extent that to-day, of the 6,660 electrical cars of Great Britain and Ireland, 90 per cent are double-deck and 10 per cent single-deck; while of the 3,517 new cars in cities having a hundred or more cars in use, 94 per cent are double-deck. That the double-deck car is well adapted to congested traffic in large cities is proved by the fact that of the 450 electrical cars in Manchester, 425 are double-deck, of the 480 cars in Liverpool, 468 are double-deck, and of the 400 electrical cars in and about London, all are double-deck.

An exhaustive study of this question has recently been made for the Merchants' Association of New York by Mr. John P. Fox, and his results are embodied in a report to the Committee on Engineering and Sanitation. This gentleman carried out his investigation during a visit to Great Britain and the European cities where it is most extensively used; and the report contains expressions of opinion from the managers and superintendents of the various traction companies in Europe as to the relative advantages of single and double-deck cars. According to the statement of the general manager of the Liverpool Corporation Tramways, when electric traction was introduced in Liverpool in 1898, it was thought desirable to follow the American practice of using single-deck cars. The main argument against the double-deck car was that too much time would be occupied in ascending and descending the staircase; but this objection was entirely met by adopting a staircase which was perfectly safe to descend while the car was traveling at any speed, and which, therefore, enabled the conductor to refuse to stop the car except at the order of a person actually on the lower deck. The staircase referred to is of the reversed type, and no accidents have ever occurred in Liverpool from people being thrown off the staircase when the car was in motion. As to the length of car stops, it was found by actual timing of these cars in Liverpool, that the average time consumed per passenger in getting on and off worked out at 1.9 seconds; whereas in a large American city where the operation of the cars is similar to that in Liverpool, the length of stop per passenger averaged 2.8 seconds on an open twelve-seat car.

As showing the great increase in capacity secured by double-decking, it may be mentioned that some of the Liverpool single-deck American cars had stairs and deck added, and were used for trial, before the double-deck car was adopted as the exclusive type for service. These cars were used on Saturdays, Sundays, and holidays, and at other times when cars of large accommodation would be required. The seating capacity was increased from forty to a hundred by the addition of sixty seats on the upper deck. The total weight of the car was only 31,360 pounds, and the two 35-horsepower motors already installed on the cars were found to be sufficient for the work. The largest closed cars in New York, the convertible Third Avenue cars, with cross seats, are about the same length as the Liverpool converted car; they weigh 3,600 pounds more, and seat only 48 per cent as many passengers. The objection will be urged against the double-decking of cars in New York city, that on certain lines the height of the elevated structures is not sufficient to allow such cars to pass under. The reply to such objection is that it would be a simple matter to raise the grade of the elevated tracks in such localities as the intersection of Broadway and Thirty-fourth Street, without working any injury to the elevated traffic. In fact, the location of the Thirty-third Street station at the top of a grade would be conducive to quick starting and stopping, and would be quite in keeping with the latest practice, which is to place all stations at the summit of a rather steep grade. Of course, the introduction of a double-deck car in this country would be met by strong opposition from the management, and this for the reason that our roads get their best profits from standing passengers. On the other hand, it seems as though standing has been overdone in this country, even if the subject be considered from the financial standpoint; for the extreme overcrowding which is witnessed during the winter months, causes loss of fares, and results in very serious loss of time in stops, it being no unusual thing for a minute or more of time to be lost while passengers are endeavoring to squeeze their way through the tightly-wedged mass of humanity on the platforms in the endeavor to board or leave the cars.

KEEPING THE HEALTH OF A CITY.

The sanitary conditions of a great city concern all who dwell within its borders, and the comparative mortuary tables prepared by its health board are being recognized more generally as important commercial assets. Nature has generously environed some cities with conditions favorable to the good health of their citizens; but continued neglect to keep pace in a sanitary way with rapidly-growing population has converted many such a town into a hot-bed of fever and contagious diseases. Of the many municipal problems pressing for solution, few demand more accurate study and investigation than that pertaining to the health of our large cities, with their vast ignorant and foreign population, congested tenement districts, crowded business places, and numerous public halls for amusement, education, and recreation. London, Paris, Bombay, Berlin, and Rome have had their scourges in the past to testify to the fearful penalty of ignorance and neglect; but American cities are young and vigorous yet, and they have escaped many of the plagues and disease epidemics that have marked the pages of ancient history.

Modern sanitary conditions have improved in the past quarter of a century in all the principal cities of the world, and we stand less in danger of widespread epidemics than ever before; but the ambition of every well-ordered city is to decrease its mortality to the lowest possible minimum. Contagious and infectious diseases may always be with us; but the prompt work of isolating and stamping them out is rapidly robbing them of much of their terror. There is a new era dawning in respect to the spread of all such diseases. Medical science has already robbed the bubonic plague of most of its dread. The appearance of a steamer in the port of New York with several cases of plague aboard barely causes a ripple of fear among its three million odd inhabitants, and yet a little more than half a century ago the terrible disease took such a strong hold of the city that grass could be found growing on lower Broadway in the busiest part of the town.

Yellow fever has succumbed to the inevitable. Havana has been relieved of its pall of death, and our own southern ports no longer fear the annual summer visitant. Smallpox has practically been controlled and brought under supervision, so that an epidemic of it in any well-regulated city is a disgrace to its governing powers and health board. We have become so well accustomed to the regulation and isolation of these violent diseases that few give much thought to them. But immunity from them is purchased by eternal vigilance and constant work on the part of those in charge of our public health. The workings of a modern, up-to-date city health board are peculiarly interesting. To the uninitiated, dealing with diseases is far more complicated than dealing with crime. Our individual danger is ten times greater from epidemics than from murders, robberies, accidents, and fires. Yet as a rule our police and fire departments excite our admiration, while the squad of health inspectors more often arouse our anger and opposition.

The Health Department of New York city deals with a total population of something like 3,500,000, extending over a vast area, and housed in almost every imaginable form of habitation. The population is the most heterogeneous in the world, representing every nationality, religion, and belief. The problem of dealing with so varied a population to enforce sanitary and ordinary health precautions is intricate and difficult. Instead of co-operation there has been more often bitter opposition. The crusade against smallpox conducted by the present Health Board in the past two years was opposed by the ignorant and superstitious, and by a considerable body of the more intelligent who were opposed to vaccination on principle. The inspectors were openly abused and resisted, and it was only through the co-operation of the police that an effective campaign was conducted. When the scare reached its height, the opposition from the tenements decreased, and the educational value of the campaign was worth all the efforts and expenditures made. It was rarely then that a case of smallpox was discovered in the tenements without being promptly reported, and, in most cases, followed by a wholesale exodus of the people to the Health Board's headquarters to be vacccinated. The dread of smallpox epidemics in New York city is thus lessened for the next twenty years. Instead of opposing and fearing the inspectors, the people of the tenements in most cases to-day show a wholesome welcome to them when they come armed with the quill and virus to save them from smallpox infection.

Contagious eye disease among the children of the public schools reached alarming proportions in the city until the Board of Health attempted to stamp it out. There were some fifty thousand children suffering from the disease at one time, but effective measures were taken to check its spread. Children suffering from it were kept at home or sent to the hospitals, and a strict quarantine placed on all the schools. The disease now has been almost stamped out. But eternal vigilance is the price of immunity. Every public school is under the immediate supervision of the Health Board. Scarcely a day passes that the children of nearly every grade are not examined. Should one of them show feverish cheeks, high temperature, or furred tongue, he is quietly examined, and sent home as a precaution. When measles, chicken pox, scarlet fever, or diphtheria break out in the home of some little scholar, his home is quarantined to some extent from the school. Each day a child coming from an apartment or house where any of these contagious diseases are known to exist must be examined by the Health Board physician before he is allowed to enter his class.

So strict is the quarantine now enforced against the schools that a scholar who has become a victim to any of the contagious diseases cannot return to his studies until a permit has been issued to him by the Health Board. This requires a personal visit from the Health Board doctor. In the private schools similar enforcements of the rules of the Health Department are now being made. Likewise churches, concert halls, and all places of amusement of a public nature are being visited and their sanitary conditions examined. Wherever people congregate together, there the seeds of disease are apt to spread and flourish, and the Health Board puts competent men on the scene to investigate. Scarlet fever, chicken pox, diphtheria, and measles are ever present somewhere in a city like New York. Several hundred new cases will develop every week in the city if left unquarantined.

In the matter of milk inspection the Health Department alone saves the city all the expense which it incurs. Hundreds of innocent babies are saved every summer by the recent rigid system of milk inspection. The doctors of the department go further. They give free instruction and directions to the poor and ignorant parents of the children. Inspectors not only test the milk as it reaches the city, but they go from store to store and make tests of milk purchased over the counter. The practice of sending inspectors to the farms in milk districts to study conditions there has been inaugurated. Instructions are given to the farmers about sanitary conditions of their cow stables and creameries, and if these orders are not obeyed, a ban is placed upon the milk coming from the spotted farms, and it is not admitted.

Milk inspection has always been one of the most difficult questions for the department to handle, for dealers, shippers, and farmers appear to combine to elude the Health Officers. Light fines were usually the only punishments for adulterating the milk, or for putting chemicals in it to increase its thickness. Under the present administration so much terror has been inspired by heavy fines and imprisonments that few dare openly break the law. Moreover, the inspection is kept up continually, and no dealer knows just when an inspector may test his samples and hale him before a magistrate.

Clean food, free from all disease germs; pure water,

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milk, and beverages, untainted by foreign substances; honest drugs, unadulterated by inferior mixtures; healthy, sanitary living and working quarters, with oxygen sufficient to nourish and strengthen life; and streets and avenues, as free from filth and dirt as broom, water, and chemicals will make them—these are the things which the Health Department stands for to-day in New York. It is what every city demands. But to get them the price must be paid—the price of energy and eternal vigilance, the price of intelligence and expert experience, the price of men and money consecrated to the cause.

CERTAIN CURIOUS EFFECTS OF THE VIOLET RAYS.

BY DR. JAMES WEIR.

This summer, while studying the effects of the violet and ultra-violet rays on plants, I discovered that these rays exerted a very unique and well-marked effect on the blossoms and foliage of the common field as well as the rarer perennial (Iceland) poppy.

Accidental happenings were, in a measure, the inciting cause for this especial study of the effects of the violet rays on the poppy. One morning I cut some poppies for decorative purposes. An hour or so after they had been placed in a vase, I noticed that they had withered. I was in the act of removing them when my mother stopped me, saying: "Don't throw them out; they will come to life during the night and will be all right to-morrow morning." My attention was attracted by the promise of such peculiar behavior on the part of poppies, and I at once began a course of observations and experiments in order to discover, if possible, the causes for this seeming death and resurrection.

On account of the rich and luxuriant foliage, the large, fleshy stems, and mammoth blossoms of the Iceland poppy, I chose it for the majority of my experiments, though the various kinds of field poppy, single, double, and fringed, red, white, and variegated, were also used and kept under observation.

It was noticed that the withering process began the very moment the flower was separated from the parent plant; the petals losing stiffness and resilience and drooping toward the stamens. This wilting continued until, finally, at the end of half or three-quarters of an hour, the blossom presented every appearance of being moribund. The immediate wilting indicated that, whatever the cause for it, that cause was instantaneous in action and had to do with the vital principle of the plant itself; there was instant interference with the life-producing and life-sustaining functions. Such cause, reasoning by analogy, must necessarily be both physical and chemical in character and action; I therefore conducted my experiments accordingly.

It was soon determined that the hour of cutting (*during daylight*) had nothing to do with the production of the phenomena, for the flowers were gathered at daylight, sunrise, 10 A. M., 12 M., 3 P. M., and 7 P. M., and it made no difference; the wilting process took place. Nor had temperature anything to do with it; the thermometer was carefully watched all through the preliminary experiments and its variations amounted to practically nothing. *But flowers cut at night would not begin to wither until they were exposed to light.* This indicated that light had something to do with causing this *quasi* death, and if this hypothesis were true, the cause was, primarily, chemical in nature and occasioned in all probability by certain particular rays.

I had discovered in former experiments that the orange, red, and yellow rays were not inimical to plant life and had published the results of those experiments and the conclusions derived therefrom in this periodical and elsewhere, therefore thought it hardly necessary to repeat them in this instance; I was satisfied I had to deal with certain unique effects of the violet ray (whose short wave of 380 $\mu\mu$ heads the solar spectrum, if spectra can be said to have heads), and those still more wonderful rays—the ultra-violet.

When those rays are cut off from a poppy by a screen of orange or red "postoffice" paper, the blossom will not wilt. The stem as well as the flower must be protected, otherwise wilting will take place. When a blossom is kept in the light (diffused daylight or electric light) for over fourteen hours, it loses the power of "coming to life" again; a longer exposure invariably kills it beyond recovery. In all experiments the stems of the cut flowers were immersed in fresh water, and all control observations carried on in a dark-room.

The most noteworthy phenomena to be observed in the effects of the violet and ultra-violet rays on the poppy are their immunizing properties. A poppy which has been subjected to the light and which has wilted and then "resurrected" *will remain unaffected when placed even in the direct rays of the sun!* An analogous process is seen in the effect of the violet and ultra-violet rays on the skin. The first exposure of those portions of the body ordinarily covered by clothing to these rays will result in destructive changes; blisters, etc., making their appearance with subsequent desquamation. But a second exposure produces little or no changes; the skin has become *immune.*

This fact of immunization will account for some of Finsen's seeming failures, if it does not account for all of them. This observer, in certain of his experiments, must have made his exposures too brief; he succeeded in getting only the immunizing effect of the rays; the exposures were too short to induce or achieve a lethal or deathly effect.

Microscopic examination shows that these rays produce marked physical changes in the cut stem, foliage, and flower. A section of the stem examined immediately after the blossom is cut shows that the effect on cell life is instantaneous; the cell at once begins to shrink and the protoplasm to collect around the nucleus. Circulation is interfered with, and this interference progresses as the blossom withers until there is no circulation in the veins and capillaries after two or three hours. Cell movement also ceases, and the entire structure presents every appearance of death. Indigo, cochineal, and eosin will be all the stains necessary for conducting a satisfactory examination and study of this exceedingly interesting instance of "suspended animation."

FRUIT AND NUTS AS FOOD.

The Department of Agriculture has for several years been conducting a series of experiments to determine the dietary value of different foods.

Nine dietary studies and thirty-one digestion experiments were carried on. In the majority of the dietary studies and all but one of the digestion experiments fruit and nuts constituted all or almost all of the diet. The results of the investigation emphasize the fact that both fruit and nuts should be considered as true foods rather than food accessories. The subjects were two women, three children, two elderly men, and two university students. The men all did hard manual labor during a part of the time, the students working to support themselves while pursuing their studies.

The fare given in these experiments was in every case one that would appeal to any normal appetite. It embraced honey, tomatoes, apples, bananas, cantaloupe, grapes, verdal, cornichon, tokay, muscat, scarlet haws, pears, pomegranates, persimmons, oranges, strawberries, watermelons, figs, almonds, and peanut butter. The only animal foods allowed were cottage cheese and eggs; and these in limited quantities. The cost of such a diet varied from 15 to 18 cents a day. Comparative experiments were carried along in which animal foods were employed under the usual conditions of living, and in these the daily cost ran from 26 to 30 cents. It was found that the food eaten supplied about 60 per cent of the protein usually secured by the average meat diet, while health and strength continued the same, if not improved, and in two or three cases there was a slight gain in flesh and weight.

One of the chief objects of the series of experiments was to furnish data as to the value of nuts as food. Fruits contain little protein, and nuts are relied on in the fruitarian plan of eating to balance the ration. Fruits are rich in carbo-hydrates and nuts in fat. A pound of peanuts, which costs 7 cents, furnishes 1,000 calories of energy at a cost of 3½ cents, and protein at a cost of 36 cents a pound. A porterhouse steak costs for the same result respectively 22½ cents and $1.31, when the steak can be bought for 25 cents a pound.

The average price per pound of the protein of nuts ranges higher than the corresponding average of meats, but the cost per pound of peanut protein is lower than for meats, fish, eggs, milk, dairy products, and prepared cereals. The only foods which furnish protein at a less cost than peanuts are flour and dried beans. According to Prof. Jaffa's experiments, nuts are the cheapest source of energy for the fruitarian, the peanut ranging far ahead of any other variety.

Although peanuts supply protein and energy for a smaller sum than bread, they are outranked by dried beans, which, at 5 cents a pound, will supply for 10 cents over 200 grammes of protein and 3,040 calories of energy.

Krafft has determined the boiling points of certain metals by the use of vessels of quartz heated by an electric furnace. Zinc sublimes below 300 deg., and at 640 deg. distills fairly quickly; the corresponding temperatures for cadmium are 322 deg. and 448 deg. Selenium distills quickly at 380 deg., tellurium at 550 deg., boiling being observable at 535 deg. Lead boils rapidly and distills at 1,160 deg. Tin proved very refractory, no distillation occurring even at 1,100 deg. At 605 deg. antimony sublimes slowly, and at 775 to 780 deg. distills rapidly. Sublimation of bismuth commenced at 540 deg., the sublimate assumed the form of drops at 930 deg., and the metal boiled briskly at 1,050 deg. A slight mirror of silver appeared at 1,090 deg., and rapid vaporization proceeded at 1,340 deg. Copper and gold boil at too high temperatures to be examined even in silica; with the former a slight amount of sublimate formed at 1,315 deg., with the latter extremely little vapor arose even at 1,375 deg., which is near the point at which the resistance of silica breaks down.

SCIENCE NOTES.

According to Bach and Battelli, the following reactions occur during the decomposition of carbohydrates in the animal system, their theories being based upon the decomposition of glucose. Glucose is first converted into lactic acid which is split up into alcohol and carbon dioxide. The alcohol at the moment of production is easily oxidized by the oxygen of the blood, with the co-operation of oxydases to acetic acid, which in its turn is decomposed into methane and carbon dioxide. The methane is oxidized to formic acid, and this is split up into carbon dioxide and hydrogen, the latter being finally oxidized to water.

That the "clinical" may be, at times, a source of danger has more than once been pointed out, and that organisms become fixed in the scratches of the glass caused by the graduation lines, so that they cannot be removed easily by simple washing and wiping, has been demonstrated. Stini has described, before the Société de Thérapeutique, a simple pocket case in which the clinical thermometer is carried always immersed in a sterilizing solution. It consists simply of a metal tube closed at one end with a tight-fitting cap, which screws on by a fine thread, and is fitted with a fluid-tight washer. The thermometer is inclosed in another close-fitting metal case, similar to that at present used, but freely perforated laterally with holes, so as to allow free access of the antiseptic to the instrument, in which it is by this means kept immersed. This smaller tube is carried in the larger one, partially filled with the liquid antiseptic. Any germicidal antiseptic may be used.

It was rumored not long ago that one of the five $40,000 Nobel prizes would be awarded to Finsen, whose light cure has made him world-famous. Although the statement is not true, there is no reason why Finsen may not be honored when the award is again made. It has long been known that there are certain rays of the spectrum which act as germicides; these are the visible violet and invisible ultra-violet rays. Finsen devised an electric apparatus which would give an abundance of violet and ultra-violet rays. The disorder which has been most readily treated by Finsen is tuberculosis of the skin, called by medical men lupus vulgaris. In a special hospital which has been established in Copenhagen, known as the Finsen Institution, 456 cases were treated up to the close of 1900. The treatment was necessarily severe, since few patients required 20 sittings of an hour each—one daily—while many needed from 300 to 500.

The Metropolitan Museum of Art has acquired the famous Roman frescoes of the villa at Boscoreale. Boscoreale has become famous since the first great finds made there ten years ago as the name of a villa on the slope of Vesuvius, near Pompeii, which was covered with ashes in the great eruptions during the year 1879. In the excavations which have from time to time been made, many an art treasure has been unearthed, which has found its way to this or that European museum. The first systematic exploration was begun in 1900. The famous villa, of which all archæologists now know, was then discovered. Erected in the most artistic taste, the walls of the building were covered with panel paintings. At first it was intended to leave the paintings on the spot, but it soon became evident that exposure to the weather would destroy them. The frescoes were cut from the walls and transported across Italy by special train. It is these frescoes which the Metropolitan Museum has acquired.

Much has lately been heard of the efforts made by Germany to establish the cultivation of various useful plants in her African colonies, but, according to P. Preuss, who is well qualified to speak on this matter, the outlook is by no means rosy. These efforts have been made in order, if possible, to render Germany independent of foreign countries for colonial products. In 1889 the government established botanical gardens in Victoria, at the foot of the Cameroon Mountains, in order to test the suitability of the climate for the cultivation of various plants, and also to produce seeds and plants for distribution. Since then no trouble has been spared to make the enterprise successful. Among the plants cultivated the cacao tree at first gave rise to hopes, but the quality of the seed soon fell off. In order to determine the reason of this, Preuss himself undertook an expedition to Central America in order to study the varieties of tree cultivated there and the methods of curing the seeds. As a result of this inquiry the prospects of the cacao cultivation have improved. Coffee and tobacco have hitherto failed, and the cultivation of other plants has been either unsuccessful or of so little value as to be of no practical importance. No matter where the ginger plants are brought from, none but typical African rhizomes are produced. Sisal hemp alone has the prospect of being a source of profit. At present more attention is being paid to india rubber, cotton, gutta percha, nutmeg, vanilla, pepper and clove, and palm oil. Earth nuts and sesame seed are looked upon as possible sources of profit.

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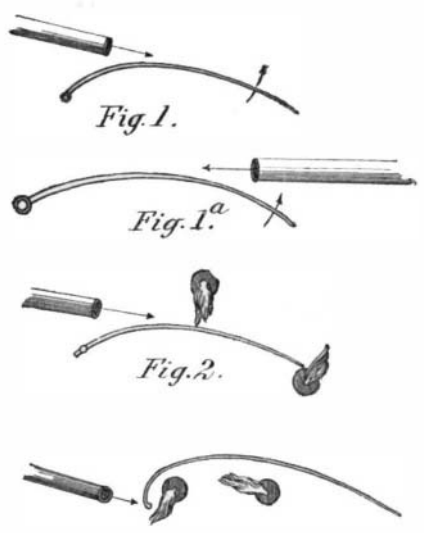
THE FLIGHT OF BIRDS MECHANICALLY STUDIED.

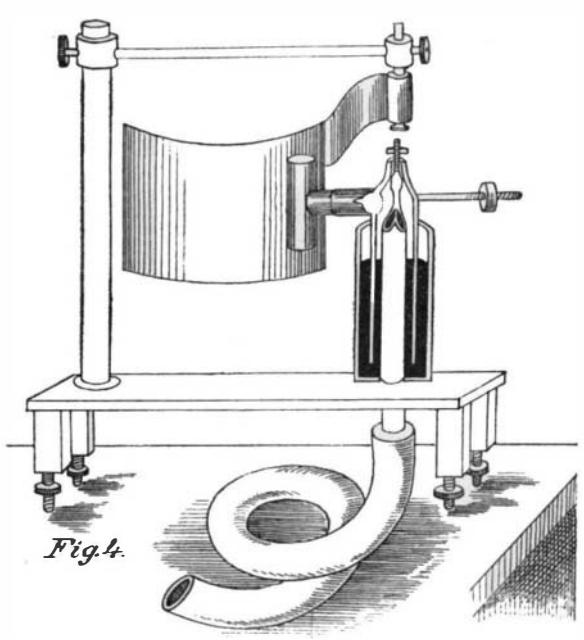
BY EMILE GUARINI.

One of the puzzles that occupy airship inventors is the manner in which a bird, while keeping its wings spread and immovable, displaces itself in the air in a straight line parallel with the horizon, and sometimes even raises itself. A flying machine with plane wings cannot momentarily sustain itself unless it be provided with a much greater extent of supporting surface, apart from questions of equilibrium and propulsion, which are not devoid of importance.

Prof. Langley, in a very interesting article in the SCIENTIFIC AMERICAN SUPPLEMENT, demonstrated in a graphic manner the great difference that had already been observed by Cayley, Chanute, Marey, and others between a bird's wings and aeroplanes. What is the cause, then, of the great advantages in favor of the wing of the bird? Goupil, Philipps, and Maxim have put forward, as a possible element, the curvature of the wing, but without offering either formulas or proofs. Hargrave, Wilbur Wright, Herrnigs, and Lilienthal, all resolute inventors, adopted in their flying machines the curved form—the "natural form," fixing the necessary convexity empirically, but with good results.



Effect of Currents of Air Upon Artificial Wings.



The Bertelli Apparatus for Experimenting Upon the Mode of Action of the Wing of the Bird.

Leonardo da Vinci, Cayley, Faccioli, and Marey have considered the curvature of the wing, but only as regards the concavity, and from the viewpoint of its greater resistance upon the air.

M. Achille Bertelli, of Brescia, an ardent student of aerial navigation, absolutely convinced that it is in the convexity of the wings that resides the great advantage that the bird possesses over plane flying machines, has analyzed its mode of action in many ways, and has thus succeeded in devising a purely mechanical demonstration of its efficacy. We shall summarize his very interesting experiments with the aid of reproductions of photographs and drawings.

In the first place we must consider his fundamental experiment. If, by means of a tube, we blow upon a slightly curved surface formed, for example, by a piece of bristol board hinged at one of its extremities (Fig. 1), in such a way that the current shall be tangent to its surface, we shall find that, under the action of the current of air that is developed, the wing, or the curved surface that represents it, will rise. The same thing will occur if the blast of air travel in an opposite direction (Fig. 1a).

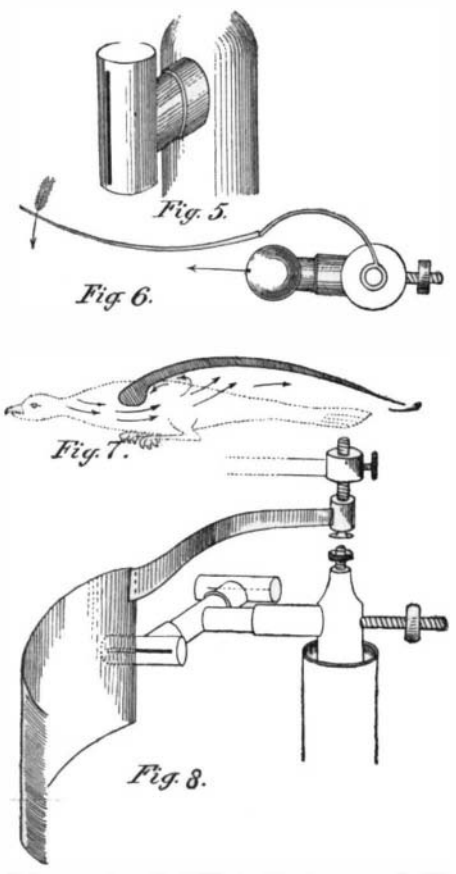


Fig. 5.—T-Pipe. Fig. 6.—Effect of Current of Air Upon an Artificial Wing. Fig. 7.—Path of Wind When a Bird is Flying Against It. Fig. 8.—Second Form of Apparatus.

On the other hand, if, upon a surface such as just described, but which is fixed and placed vertically (Fig. 2), we blow as before, we shall see that the flames of candles properly arranged near the wing, will move in opposite directions, that is to say, the one placed at the center of the wing will approach the latter and become perpendicular to it, while the one placed at the end will move away from it and become perpendicular to it also. If, on the contrary, we blow as shown in Fig. 3, the flames placed in the concavity will be directed in the opposite direction from the blowing.

M. Bertelli, for carrying out his experiments, has invented various apparatus. The first of these (4) is used for showing how a current of air, in striking a curved surface tangentially, tends to "absorb" it. It demonstrates why a curved surface, like that of a wing, usually possesses a supporting power greater than that of an equal plane surface, and also why, in flight with wings in motion, the latter, when being raised for a new stroke, meet with no resistance in the air,

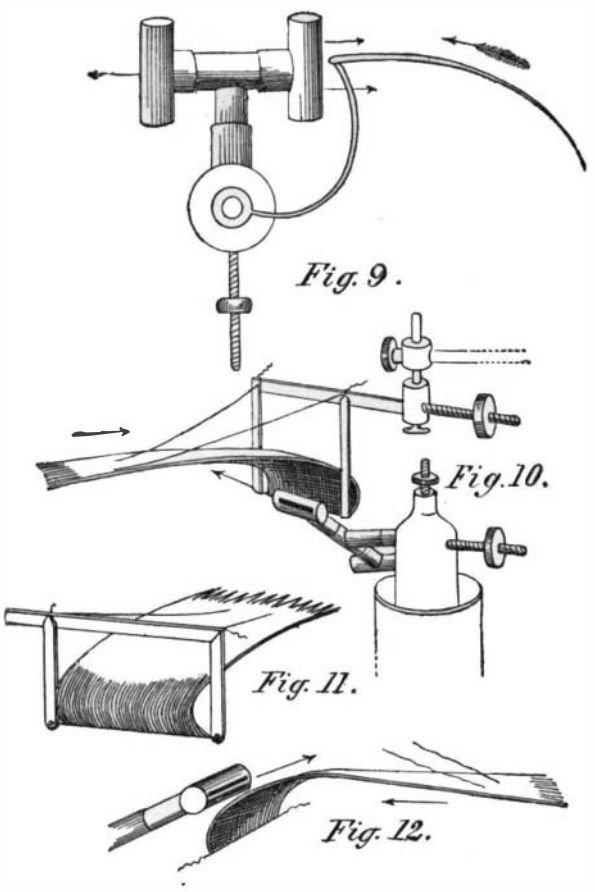


Fig. 9.—Second Form of Apparatus. Figs. 10 and 11.—Third Form of Apparatus. Fig. 12.—Advance of Artificial Wing Against a Current of Air.

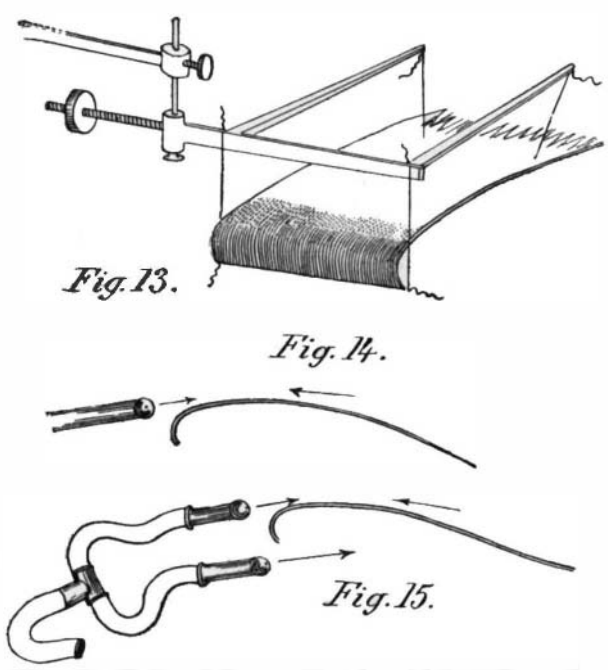
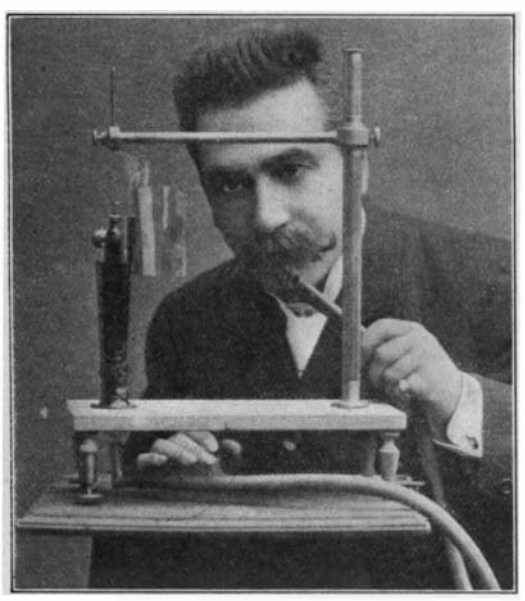
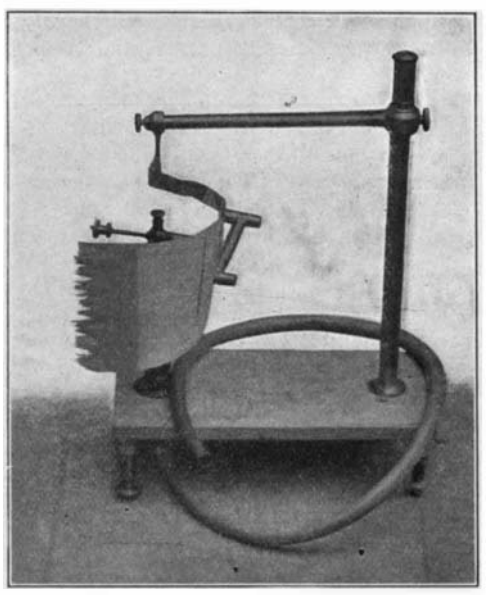


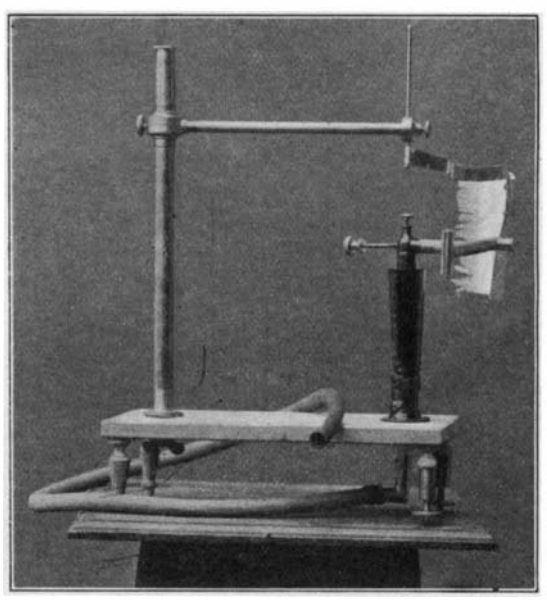
Fig. 13.—Mode of Suspension of Artificial Wing. Fig. 14.—Advance of Wing Against Wind Pressure. Fig. 15.—Arrangement for Blowing Air Against the Convexity and Concavity of a Wing.



How the Apparatus Shown in Fig. 4 is Used.



The Double-T Blast Apparatus.



A General View of the Apparatus Shown in Fig. 8.

THE FLIGHT OF BIRDS MECHANICALLY STUDIED.

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which strikes them tangentially from above, but are aided in their elevation.

The apparatus (Fig. 4) consists of a metallic tube fitted with a rubber hose. This metal tube communicates with a vessel half filled with mercury, and is covered with a bell, which is provided with a T-pipe, the T being closed at each end, but formed with a vertical slit (Fig. 5). The wing, which is sustained by a screw support, consists of a curved sheet of very light metal. The blowing is done through the rubber hose, shown at the bottom of the apparatus in Fig. 4. Upon bringing the back of the wing near the slotted T (Fig. 6) in such a way as to leave a space of nearly half an inch, and upon blowing into the T, the wing will be seen to move against the latter.

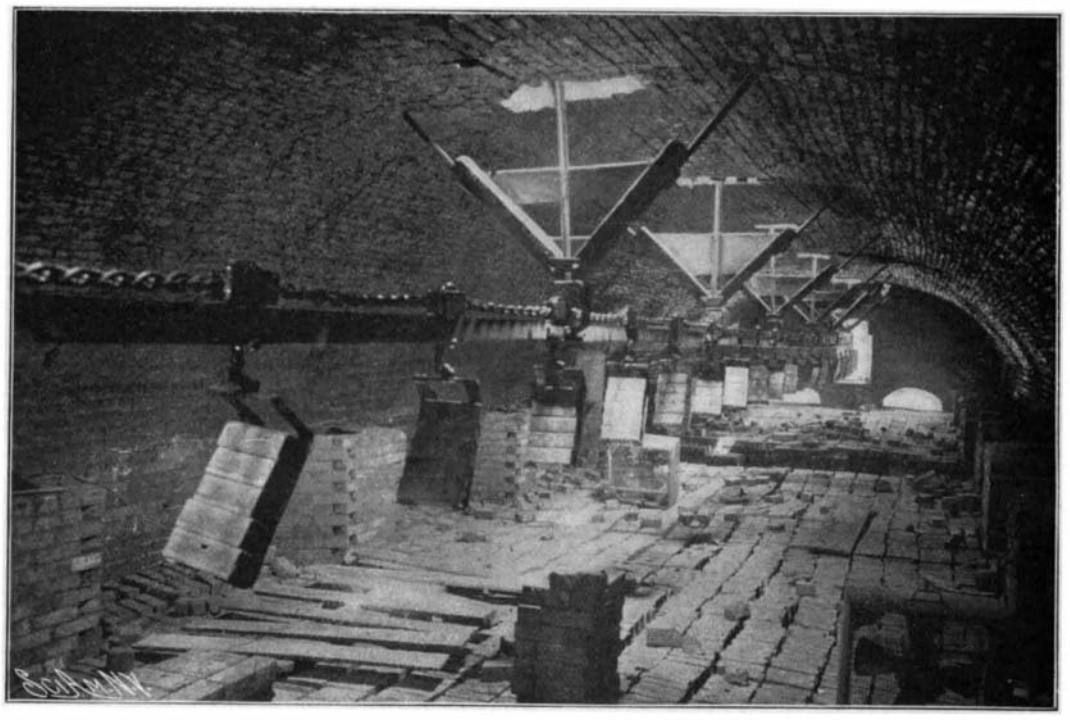
The second apparatus (Figs. 8 and 9) differs from the preceding only in the fact that the bell tube terminates in a double T, each T being vertically slotted and revoluble so that the slips can assume horizontal, oblique, or vertical positions. This apparatus is designed to reproduce and verify the effect produced and the path followed by the wind when a bird is flying against it (Fig. 7). The wing employed in this apparatus is formed of light cardboard cut along its edge to form a fringe. The wing is carried by a very elastic band. Upon blowing, the wing is drawn toward the T. If the blowing be continued, there will be obtained a continuous rotary motion the reverse of that of the current of air. The same effect will be obtained whether the blowing be done upon the back or in the concavity of the wing.

The third apparatus (Figs. 10 and 11) is similar in purpose to the preceding. This time the wing is secured horizontally to a light quadrangular support, and held in the position desired by means of two threads. If the blowing be done toward the center of the wing, the latter will advance against the wind (Fig. 10); and the same thing will occur if the blowing be done upon the back (Fig. 12).

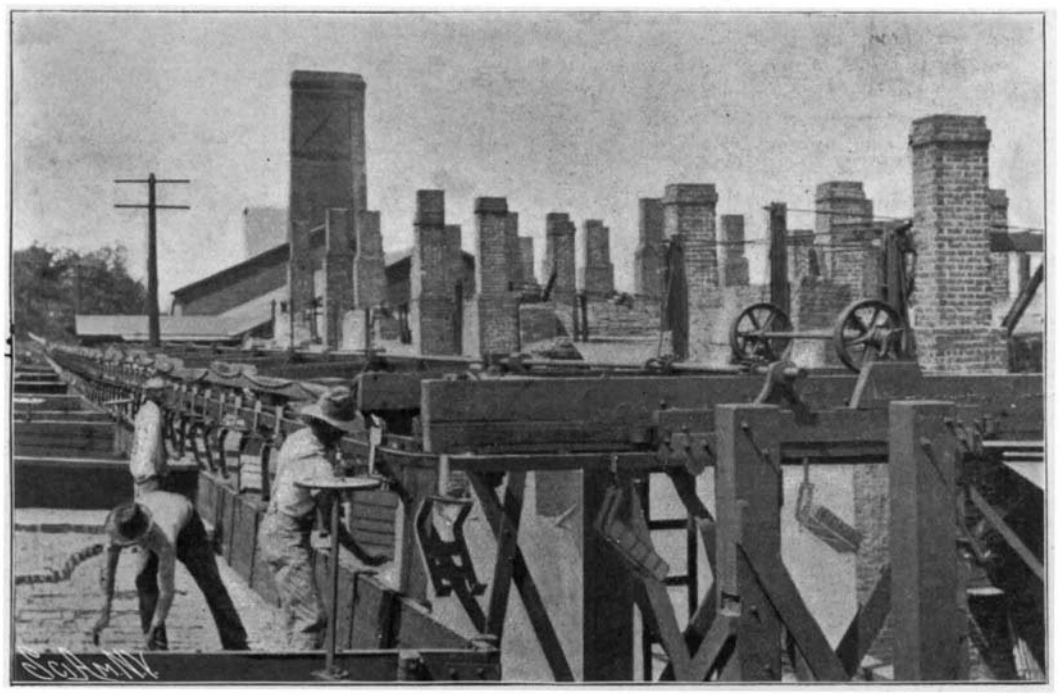
In order to perform these and the following experiments successfully, great patience is required, since it is important that the current of air and the plane of the wing shall describe a precise angle difficult to fix. This angle varies, moreover, with the curvature of the wing.

In the fourth apparatus, the wing is perfectly free to move and balance itself under the various pressures exerted upon it by the currents of air. We thus imitate as nearly as possible the wing of the bird. The wing is held (Fig. 13) in a horizontal position by four threads attached to an appropriate support. If we blow with the usual slotted T tangentially to the back of the wing (Fig. 14), the latter will advance against the pressure; and the same will be the case if we blow simultaneously above and beneath the wing (Fig. 15). It is naturally necessary to find the exact point of tangency and to give the wing a proper curvature. The slightest error will lead to a failure. It seems that it must be concluded from what precedes that the bird is an equilibrist of the first rank, which instantaneously modifies its motions according to the direction of the blowing of the air. Does it act automatically? This is a mystery of Nature.

Prof. Bertelli, president of the Reale Societe di Fisica Italiana, believes that these experiments, which are apparently paradoxical, may be explained by the application of the mathematical formula commonly employed for demonstrating, in applied mechanics, the action of a tangential force upon a curved surface. Other physicists will not admit this, and maintain that the thing is more complex. Such, for example, is the opinion of Col. Borgatti, director of the Italian aeronautic service. Whatever be the explanation, it follows from M. Bertelli's mechanical demonstration that Nature has endowed birds with concavo-convex or, better, parabolic wings, in order to give them: (1) a double supporting surface, that is to say, beneath and above the wing; and (2) an automatic means of propulsion, owing to the fact that the wind, whirling around in the opposite direction under the curvature of the wing, absorbs it. The convexity of the wing draws the wind upwardly, so that it acts tangentially upon the end of the wing with a propulsive effect—a fact which better explains the elasticity of the ends of the remiges. If to this we add the great efficiency of resistance upon the air possessed by the concave wing—an efficiency first established by Leonardo da Vinci and by others afterward—we shall understand how the bird sustains itself and easily moves in the air by a minimum exertion—a phenomenon, however, that agrees with Nature and which is by no means mysterious. It is to be hoped that experiments such as Bartelli's will be carried out on a larger scale by means of instruments of precision either for studying curvature, convexity, and angles, or for estimating wind power and resistance. From such experiments it might be possible to deduce formulas and forms of wings extremely useful in solving the great problem of aeronautics.



Discharging Brick from the Kiln.



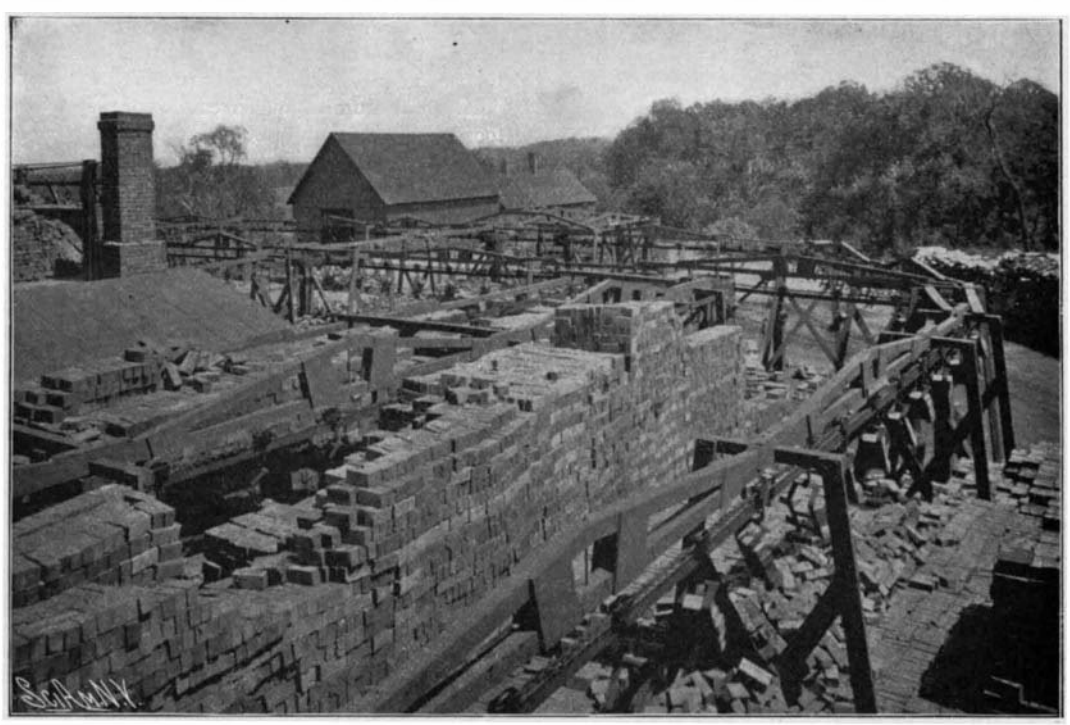
Loading Brick Directly into the Cars.

THE BARNEY BRICK CONVEYER.

The illustrations which are presented herewith picture the Barney brick conveyer, an apparatus which is adapted for the transportation of bricks in plants of either large or small capacity. The apparatus is made by the Jeffrey Manufacturing Company, of Columbus, Ohio. The conveyer consists essentially of three parts—an endless carrier chain, a swinging basket, and an overhead track or runway.

The endless chain is of the coil pattern, and is usually made up in sections four feet in length, connected with special roller carriers, to which the baskets are attached.

The chain operates over special pocket sheave wheels, and is driven from the head of the conveyer. The individual roller carriers are made with a grooved wheel, to operate in a single iron bar runway. This runway is suitably supported from hangers fastened upon wooden trestles, and is supplied with curved connections wherever it is necessary to turn an angle or to round a curve. A special adjustable device is used at the drive end of the system, to keep the chain taut upon the wheels. An adjustable or sliding frame, which can be moved backward or forward without stopping the conveyer, is employed along the point where the railroad cars are to be loaded. The con-



The Conveyer Arranged in the Stock Piles.

THE BARNEY BRICK CONVEYER.

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veyer can be disconnected at any point; the sections can be run in almost any direction. The overhead track is constructed to such points in the yard as will best serve the distribution of the brick; it can be built at varying heights and on any reasonable grade.

The baskets, each having a capacity of five bricks, move continuously, at a speed of about three feet per second. Consequently five bricks per second are carried past any given point if the baskets are full; that is, five bricks per second, 300 bricks per minute, 12,000 bricks per hour. Such would be the capacity of the conveyer if the baskets were spaced three feet apart.

Should a greater capacity be required, the baskets could be placed closer, for example, two feet apart; the capacity would thereby be increased to 27,000 bricks per hour.

A change of the speed is also permissible, by which the maximum capacity can be varied, close to 100 per cent. It is not necessary to fill all the baskets; they operate empty, as well as full. Two men can "put on" the conveyer; one man can "take off." One good man could "put on" from 2,000 to 3,000 bricks per hour, depending on the size and weight of the bricks. The power required to operate the machine is very small, and may be roughly estimated at 1½ horse power for 1,000 feet of conveyer, in operation. The repairs, as near as they can be figured, amount to about one mill per thousand bricks conveyed.

Annual Report of Commissioner of Patents.

The Commissioner of Patents has published his report for the fiscal year ending June 30, 1903. From it we gather that there were received in the last fiscal year 49,199 applications for mechanical patents, 801 applications for designs, 156 applications for reissues, 1,767 caveats, 2,530 applications for trade-marks, 1,208 applications for labels, and 362 applications for prints. There were 29,892 patents granted, including reissues and designs, and 2,194 trade-marks, 910 labels, and 233 prints were registered. The number of patents that expired was 23,390. The number of allowed applications which were by operation of law forfeited for non-payment of the final fees was 4,760. The total receipts of the office were $1,591,251.04; the total expenditures were $1,423,094.40, and the surplus of receipts over expenditures, being the amount turned into the treasury, was $168,156.64.

Such has been the increase in the amount of business that the Commissioner strongly recommends that an appropriation be made for the establishment of a new division to handle the increased work. By the appropriation bill of April 28, 1902, an increase of thirty-five examiners and three clerks was made. A still larger clerical force now seems necessary. At least ten new clerks will be required.

Artificial Niagara at St. Louis.

An immense artificial cascade has been determined upon by the authorities of the Louisiana Purchase Exposition as the centerpiece of the semicircular layout of the principal buildings. The cascade itself will be divided into three parts; a large middle cascade with a smaller one at each side will be installed, the water flowing directly into the head of the Grand Basin. In all, about 90,000 gallons of water per minute will be supplied at a head of 159 feet, forming the greatest artificial water effect ever attempted.

The water will be taken from the Grand Basin itself, and will be raised to the top of the cascade by a pumping station located under Festival Hall. The pumping machinery will consist of three 36-inch single-stage Worthington turbine centrifugal pumps, each driven by a 2,000-horsepower Westinghouse alternating current motor. The total horse power utilized will thus be 6,000, making this the largest electric pumping station in the world. The pumps and other pieces of machinery for this plant are now being installed at St. Louis.

The Current Supplement.

A full-page drawing by A. Castaigne, representing an anti-alcoholic lecture in a French criminal sanatorium, opens the current SUPPLEMENT, No. 1449. Sir Norman Lockyer's thoughtful address on the "Influence of Brain-Power on History" is concluded. Mr. Percy G. Stiles in an instructive psychological article reviews our present theories of sleep. The discussion of the mining and manufacture of rock salt in New York State is concluded. Emile Guarini presents an account of the building of a suspension bridge at Vernaison. Mr. E. O. Hovey reports with some fullness the proceedings of the recent International Geological Congress, which he attended. The Paris correspondent of the SCIENTIFIC AMERICAN describes the manufacture of the Longuemare carbureter. An exceedingly valuable form of projection apparatus for scientific work is fully described by L. B. Elliott. The usual Trade Notes and Recipes, Selected Formulæ and Consular Notes will be found in their customary places.

Electrical Notes.

Though largely used, machine tools are virtually not made at all in Russia. The first on the market were of American make, but were introduced by German agents. These were found to be somewhat too light and delicate for the Russian workman, and the German agents, seeing this, got German firms to turn out a stronger article, which now is in considerable use. According to the British Consul at Moscow, British makes are only to be found in the best shops, and only the wealthy can afford to use them.

The filament in glow lamps gradually diminishes in diameter in consequence of the slow volatilization of the carbon. According to the Elektrotechnische Rundschau, a German firm introduces into the glass globe certain chemical compounds with a high boiling point; these, under the influence of the temperature in the lamp bulb, slowly give off vapors containing carbon, which is deposited on the filament, thus making up to a large extent for the loss referred to above, and keeping the resistance and also the brightness of the lamp more uniform throughout its useful life.

It is not to northern China that one would usually look for an example of electrical progress, but there is at least one place on the eastern shore of the Liaotung Peninsula which might well set an example to many of the western towns. We refer to the city of Dalny, which lies near Port Arthur in that portion of the Chinese empire which was leased to Russia in 1898. Electrically, Dalny is up-to-date. It has both telephones and the electric light. The central station, which is considered the finest electric plant in Asia east of Singapore, was finished over a year ago. It is equipped with three of Ganz & Co.'s generators, with a total of 1,000 horse power, and has a reserve space for additional machines to double its present capacity when required. Dalny, besides other things, is an important seaport, and has a drydock 380 feet long, 50 feet wide, and 18 feet deep, which is equipped throughout with electric pumps. A larger drydock is building, at which electricity will also be adopted. In connection with the drydock are the harbor repair shops, with foundry, smithy, machine and fitting shop, boiler shop, etc. All these shops are electrically driven and lighted throughout. Dalny also boasts an excellent telephone service, and altogether it may fairly claim to be one of the most progressive cities in the East.

In an instructive article in the Engineering Magazine, Alton D. Adams, who is well known to the readers of this journal as a contributor, shows to what extent aluminium is used in place of copper for the transmission of electricity. Besides being used for the line between Niagara and Buffalo, some twenty miles in length, aluminium has also been adopted for several other transmission lines, among which may be mentioned two in California, which are respectively five and seven times as long as the one at the Falls. It seems that about a thousand tons of aluminium have been thus employed. Although in conductivity, aluminium is somewhat inferior to copper, and although an increase of 66 per cent in the size of the wire is therefore needed to do the same work, still the extreme lightness of the metal in the end triumphs. Only half as many pounds of aluminium are required as copper. Consequently, when the price of copper was over 17 cents a pound, aluminium at 35 cents was found just as cheap. Mr. Adams points out several advantages which result from the lower weight of aluminium. The poles can be placed further apart, or lighter arms and pins can be used. The result is greater cheapness in the actual work of constructing the line. It happens that aluminium wires do not so readily work loose on the insulators, on account of the larger sag allowed. The leakage of current from wire to wire through the air with a given voltage or volume is smaller with a large conductor than with a small one. On the other hand, the wire of large cross section has the disadvantage of giving the wind a good hold when blowing at right angles.

The use of magnets for the separation of paramagnetic particles from other materials is of considerable practical value in different manufacturing industries. The idea is employed, for instance, in attrition machines, which are used for grinding rice chaff into small particles, to be mixed with more nutritious ingredients, to make cattle food. These attrition machines consist of two metal disks turning in opposite directions, being separated by one-eighth to three-sixteenths of an inch. The disks are indented to give a grinding surface, and with each revolving at a rate of from 1,500 to 2,000 revolutions a minute, it can readily be seen that iron or steel particles in the light chaff ground between the disks may cause sparks which would give rise to a destructive fire. To extract such particles, the chaff, before reaching the disks, is passed in close proximity to strong magnets, which attract any bits of metal with enough force to draw them from the chaff. A similar contrivance has been used in flour mills, where it is well known that a slight spark will oftentimes cause a violent explosion of the fine dust which collects in flour mills.

Engineering Notes.

The American Bureau of Navigation reports that during the month of July 117 vessels, of 25,460 tons, were built and officially numbered in the United States. Twelve steel steamers accounted for 18,999 tons, two of them being vessels of between 4,000 and 5,000 tons for the American Shipbuilding Company.

According to the Russian customs returns, Germany exports into Russia a quantity of articles immeasurably greater than we do, and of a class in which we could to a great extent compete in that country were greater attention shown to the requirements of the Russian market by our manufacturers.

The Berlin municipality has an agreement with the electricity works whereby it can take over the works in 1915. The town receives 50 per cent of the net profits after 6 per cent has been paid on the share capital up to $5,000,000, and 4 per cent on any excess over that amount. The works have the right of supplying the tramways at a rate not exceeding 10 pfennigs per unit.

The airship which Dr. Barton is constructing is approaching completion. It will be supported by a projectile-shaped balloon having a capacity of 230,000 cubic feet, and being 170 feet in length. The deck will be 123 feet long. When the motors are put in and the crew is on board, the total weight of the ship will be nearly seven tons. Three motors, each of 50 horse power, and driven by petrol, will work six propellers. The motors will be placed on aluminium bridges in the bows, amidships, and astern. For the purposes of raising or lowering the airship thirty aeroplanes have been provided. These will measure 15 feet by 3 feet.

Some recent publications issued by the Indian government deal with the sizes of railway wagon wheels. The present standards for the 5 foot 6 inch gage require wheels to be 3 feet 7 inches in diameter, and the maximum axle load allowed is 12 tons. The Bengal-Nagpur line, however, wish to adopt 2 foot 9 inch wheels, and to raise the axle load to 14 tons. The authorities are, however, averse to change, as the height of Indian platforms has been fixed so as to suit the large wheels; and, in view of the proposed increase in axle loads, Sir A. Rendel reports the 2 foot 9 inch wheel as not worth trying, though experiments are to be made with a limited number of 3 foot 1 inch wheels.

An unlooked-for sequence in the drainage of New Orleans is the appearance of hordes of ants which, according to the Iron Age, have become as threatening as the plagues of Egypt. They attack the woodwork of houses and speedily destroy it, making their way into warehouses where costly goods are stored, and seem to be immune to insecticides. The presence of them in such quantities is said to be caused by the drying out of the soil. When it was saturated the ants could not breed in it; now that it is no longer wet the ants have multiplied in such numbers that they defy suppression.

A method of introducing phosphorus into molten metals has been recommended by Mr. Edwin S. Sperry in the Aluminium World, namely, first to coat the phosphorus with copper by immersion in copper sulphate solution. If properly plated, the phosphorus sticks can then be handled with perfect impunity; in fact, a piece of phosphorus so coppered was laid by Mr. Sperry for several hours in a mid-day August sun without ignition having taken place. Although phosphorus when copper plated is perfectly suitable for alloying just as it stands, it is nevertheless better first to make a rich phosphor alloy and use the latter as the medium for adding phosphorus.

Locomotive trials of a scientific nature will be carried out under the general direction of the Pennsylvania Railroad at the Louisiana Purchase Exposition. That company will have an elaborate display covering all features of railroading, which will be in charge of Mr. F. D. Casanave, formerly general superintendent of motive power on both the Pennsylvania and Baltimore & Ohio systems. In making these tests he will be assisted by an advisory committee of which Prof. W. F. M. Goss is president. Mr. Casanave is now in Europe to secure the co-operation of railway companies there in these tests, in order that the results may be comprehensive as respects types of locomotives which are tested. The Pennsylvania Railroad intends to give every facility for making these trials of the greatest possible usefulness, and it is reasonable to expect that the tests of representative engines from many countries under exactly similar conditions will do much to clear up certain disputed matters of design.

The Paris-to-Hull Balloon Trip.

Count de la Vaulx and Count d'Outrement recently succeeded in journeying from Paris, France, to Hull, Yorkshire, in a balloon in seventeen and three-quarter hours. This is the first time that a balloon has successfully traveled from France to England. The Count de la Vaulx is one of the best-known of French aeronauts. He is chiefly known for his unsuccessful attempt to cross the Mediterranean.

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THE PETROLEUM DISTRICTS AND MUD-VOLCANOES OF JAVA.

BY A. BOSCH.

COMPARATIVELY little is known of the great oil deposits of the Far East. Yet, in Java, Borneo, Japan, and the Oceanic Islands oil has been "struck" in great quantities. Most of the Javanese petroleum comes from the eastern part of the island, appearing in Tertiary lime formation.

Naturally the question arises: Why is petroleum found on the north coast and not on the south? This is not only a peculiarity of Java, but also of Sumatra, Celebes, Borneo, the Philippines, Japan, Roumania, Pennsylvania, Texas, Gulf of Mexico, and Argentine. If we examine the geographical situation of these deposits, we find that they are all bayous or inlets of the prehistoric sea, protected from the ocean currents and destructive influence of the waves. The waters being comparatively calm, the slime was allowed to settle, and these districts were therefore rich in food for sea animals and lower forms of life.

The question as to whether most petroleum is of animal origin or not, can be considered as pretty definitely solved. The fact that most petroleum is found in these old bays or inlets of the sea, where the waters were for the most part undisturbed, almost compels us to give credence to the theory that it was here where the Foraminifera and other small sea animals made their abode. Wherever the coast was only swept by the ocean currents we find sporadic oil deposits in smaller bays or inlets.

In the districts above mentioned, we see this theory substantiated. Along the Atlantic slope of the Alleghanies no oil is found; on the south side of Java and Sumatra very little or none; on the Sumatra side of Malacca none. In the Japanese isles, oil is found only where the coast faces the Asiatic continent. In Baku, Texas, Mexico, and Argentine, the same fact is noticeable.

The Javanese oil appears in gas wells, asphalt springs, and mud-volcanoes. The greater part of these phenomena appear in the districts of Surabaja, Rembang and Semarang. The importance of the deposits was only recently recognized.

In 1888, an energetic Dutch engineer named Stoop founded the Dordt'sche Petroleum Company with a capital of $140,700. Borings were begun in the Surabaja district, and a refinery built.

Eight years later the company built a second refinery in the Blora district on the Solo River. The wells which supply this second refinery are situated some miles distant. They are all gushers. The refinery in Blora refines not only its own petroleum, but also that of the Tinawon Company. The oil districts are very dry and hot. Teakwood grows upon the mountain tops. The valleys and gulches are jungles of virgin forest. As the borings were made mostly in these jungles, a space some square yards in extent had to be cleared of underbrush and trees in order to obtain working room for the derricks.

The Dordt company bores mostly by hand. The water for flushing out the wells has to be first obtained by sinking wells in other places, then piped to the place desired and stored in tanks.

The oil from the gushers is delivered into the tanks at the pumping station and is there allowed to settle, and then pumped some miles into the refinery on the Solo River. The pumps used are all of the Worthington type, being driven by steam. The petroleum residue from the refinery is used as fuel for boilers. The Solo River refinery is capable of turning out 50,000 cases of refined illuminating petroleum monthly. This refined oil is pumped to Blora, 20 miles away, by pipe line, where a can factory is situated. The cans are of the usual 17-liter capacity. A part of this oil is kept for local consumption, the balance being piped to the station of the Semarang-Joanna street railway company, where it is shipped in tank cars through the entire length of Java to its 25,000,000 inhabitants.

The most popular form of receptacle or can for the Javanese and Chinese buyer is the well-known Standard Oil 10-gallon can, packed in cases of two each. The natives use the empty cans for many different purposes—tin roofing, water tanks, flower pots, etc. The crates are also used for roofing and other household purposes. This weakness of the natives is catered to by the Standard Oil Company and other competing refineries throughout China and India, all using this form of can.

In connection with the oil wells, these districts offer many other interesting sights, the most conspicuous being the so-called "mud-volcanoes." The name, however, is very misleading, as these mud springs have nothing whatever to do with genuine volcanic action. Only in outer appearance are they to be classed as volcanoes.

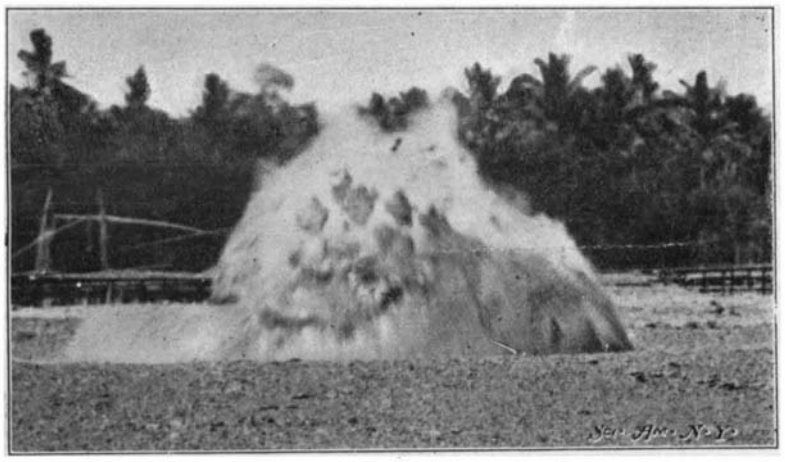
From all accounts, mud-volcanoes are to be found in Upper Burma, Timor, and on some of the neighboring isles. They are all either in full activity or subject to periodical eruptions. Mud-volcanoes are also found in Baku and further south on the Mekran coast in South Persia. Those at Baku are now extinct, while of those on the Mekran coast very little is known. It is surmised, however, that they are either extinct or subject only to periodical eruptions. Those at Minbu, in Upper Burma, are in full activity. The Javanese mud-volcanoes are situated on the extension of limestone strata in the Blora and Semarang districts, the volcanoes being situated in the recent alluvial beds and not resting directly upon the limstone.

A visit to these mud springs is most impressive. In the distance one beholds a large dry spot, entirely denuded of vegetation and strongly contrasting with the beautiful forests which surround it on all sides. Here and there within this inclosure the earth suddenly rises up to a height of 15 or 20 feet and then bursts with a muffled report, throwing mud and earth in all directions. Clouds of steam issue from the vents, and an odor of petroleum is very noticeable.

These eruptions take place every 25 seconds to 2 minutes. The Javanese mud-volcanoes do not build the usual conical mound around the crater or vents, as do those of Upper Burma and Baku, the reason being that the mud and ground around them are too liquid, simply falling back into the opening left by the recent explosion.

The taking of the photograph of one of these volcanoes reproduced herewith was a rather difficult task, since the ground was very shaky and the heat intense. It is, of course, impossible to get nearer than 150 or 200 feet. The only way in which it is possible to photograph is by laying boards so as to keep from sinking into the loose earth and mud beneath.

An explanation of this interesting phenomenon is to be found in the gas pressure within the limestone strata. These "volcanoes" exist only since the Tertiary period and after the formation of the limestone. The faulting of the strata produced fissures through which the gas and solid hydro-carbons find their way to the surface. Gradually, however, these fissures were covered over with alluvial deposits, which, in mixing with the liquid hydro-carbons, produced a slimy, pasty mass, through which the gas naturally forced its way to the surface, producing each time a miniature volcanic eruption. In course of time, great masses of fine material and mud were deposited and began to solidify. The strata increase in thickness, gradually impeding the passage of the gas and finally stopping the flow altogether. This explains the periodical eruptions of mud-volcanoes and the ever-increasing length of time between the eruptions, and their final extinction. The flow of hydro-carbons also diminishes, causing the overlying mud to become more viscous and harder, so that gas, in forcing its way through such a layer, would naturally throw up conically shaped mounds or humps, before breaking through. If then the flow of solid and liquid hydro-carbons cease altogether, the cones or mounds remain standing where thrown up. Such is the condition of the mud-volcanoes of Baku. In the vicinity of these "volcanoes" in Java, the natives mine salt by digging holes in the ground, dipping the water out and pouring it into bamboo troughs, where it is allowed to evaporate in the sun. Another very interesting sight near these mud-volcanoes is the "eternal fire" of Demak. Inflammable gases issue from a fissure in the rocks. This phenomenon is of course held in religious awe by the natives.



A JAVA MUD-VOLCANO.

Nickel-in-the-slot machines are in use in Dawson City, Alaska, for selling water in the winter. One can put in a nickel and get five gallons of water, but no more. It is so cold there that the water supply in the houses is shut off so that the pipes will not freeze every night.

Action of Magnetic Field on the Infusoria.

The recent experiments of Messrs. Chéneveau and Bohn, of Paris, show that the magnetic field has a marked action upon infusoria, and this opens the interesting question of the action of magnetism upon animal life in the lower as well as the higher orders. One of the reasons why similar experiments have not succeeded lies in the fact that the specimens were not exposed long enough to the action. Another reason is that it is difficult to form a magnetic field which is both intense and of long duration, as the experimenter is limited by the considerable rise of temperature which is caused by the magnetizing current. The specimens must be protected against the action of the heat. The experimenters overcame the difficulty by using a large electro-magnet of the Carpentier pattern with conical pole-pieces, placing between the poles a glass tube containing the specimens, 0.14 inch in diameter, surrounded by a larger tube. In the space between the tubes water was made to circulate, and this gave a constant temperature in the inner tube. To check the operations a number of identical specimens were placed apart in a similar tube at the same temperature, which was varied from 16 to 19 deg. C. in the tests. The mean value of the magnetic field was 5,000 units with the first electro-magnet and 8,000 with a second. A centimeter cube of bouillon culture was divided between the experimental tube and the check tube. The observations on the infusoria were as follows: 1. Swimming infusoria: a. Carnivora.—Three experiments were made on the marine loxophyllum, exposed to the stronger and weaker magnetic field during three or four days. The specimens in the reserve tube while multiplying in the ratio of 1 to 4, preserve their usual aspect; they are constantly searching for prey and move across the field of the microscope at an average of 400μ per second. As to the specimens placed in the magnetic field, their aspect changes after the second day, and their movements become slower, 134μ per second. On the fourth day the speed is but 80μ per second and the number of specimens decreases in relation to the check specimens by 1-3, 1-4, and 1-13. The fact to be brought out here is that the diminution in the intensity of the ciliary movements is the first effect of the magnetic field, and this effect is found among all the specimens observed. b. Herbivora.—One experiment was made upon the Colpidium colpoda in the field of 8,000 units during five days. On the fifth day the movements had become five times slower and the number of individuals was relatively small. In both cases the specimens multiplied, but in the magnetic field the generations succeeded each other more slowly and irregularly and the individuals of the new generation, instead of growing regularly, remained of small size. Finally there remained scarcely any but atrophied specimens, 40 to 30μ instead of 80 to 70μ, which died off in great number. This shows that when multiplication takes place in the magnetic field the new individuals do not grow. Still more significant were the experiments upon other varieties including the fixed infusoria, both marine and soft water varieties. In these cases the specimens were destroyed in a few days and did not multiply, showing that the magnetic field has the property of destroying some of the lower orders of life. In the case of the fixed infusoria the coloration of the living specimens according to Prowazek's method shows a progressive chemical alteration of the protoplasm.

It will no doubt be possible in further experiments to determine the causes of the action of the magnetic field upon such organisms. For the present it seems to be clearly proved that the magnetic field modifies the ciliary movements, the growth of the specimens, and their multiplication. It rapidly produces all the phenomena of aging. Lastly it is capable of destroying certain organisms completely. Starting from these experiments it is an interesting question to find out whether the magnetic field acts upon the more complex animals, and the work which is now being carried on seems to show an affirmative result.

After some eighteen months' observations by English and French astronomers, the difference between the Greenwich and Paris meridians of longitude has been fixed at 9 min. 20.909 sec. The investigations concerning this error have been carried out independently at both the Greenwich and Paris observatories. As the former meridian is the standard for nearly the whole world, the Parisian meridian will have to be adapted to it, since any alteration in the Greenwich meridian would entail endless complications all over the globe, not only concerning boundaries of countries and other geographical positions, but also private land possessions, such as cattle ranches and so forth. Arrangements are now being carried out to determine the difference in the meridian of longitude between Greenwich and Potsdam.

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THE LARGEST HYDRAULIC CANAL LOCKS IN THE WORLD.

BY A. W. FULLERTON.

The project of connecting Lake Huron with Lake Ontario, which the government of Canada has been carrying on for some years, involves the construction of some twenty miles of canals in a total distance, by the Trent Valley route, of two hundred miles. The remainder of the route is a system of lakes and rivers, over which it is planned to transport western freight between Georgian Bay and Lake Ontario, a shortening of 250 miles on the existing Lake route. The highest point in this route is 600 feet above the level of Lake Ontario, necessitating at the eastern end a series of drops, the largest of which is at Peterboro, Ont. The canal at that place makes a cut of four miles through the country, with a drop of sixty-six feet, which has been overcome by the construction of the largest locks of their kind in the world.

The Peterboro locks, which are to be opened for exhibition in October, consist of two water-tight steel boxes, in which vessels will be raised or lowered by hydraulic power from one reach to the other. These pontoons are each 150 feet long, seven feet deep, and thirty-eight feet wide, and the pistons on which they are supported are five feet in diameter, of seven-inch steel. Only two minutes is required for the raising or lowering of one of these pontoons, which work independently or together, one vessel going up while another goes down. In the masonry 25,000 cubic yards of cement were used. The side towers are 114 feet high, and a public driveway passes through the main structure. The pumps and other machinery by which the locks are operated are in a series of chambers between the driveway and the towers.

The locks, which are placed side by side, are in reality steel sections of the canal with water-tight gates adjusted at each end. The weight of each lock is supported by two massive steel cantilever trusses, the truss being deepest, of course, at the center, where it rests upon the vertical pistons. When a vessel is passing from the higher to the lower level, the movable pontoon is raised until it is in alignment with the upper level of the canal. The steel towers adjoining the canal are opened, the vessel floated in, the doors closed, and the pontoon is sunk to the level of the lower reach of the canal, when the forward gates are opened and the vessel is floated out.

There is only one other such lock in the world, and that is a much smaller one located in Germany. The Canadian lock has been built upon a similar plan, with, of course, many modern improvements incorporated. Its total cost is just one million dollars.

AN INGENIOUS SCULPTURING MACHINE.

BY THE LONDON CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A machine that is attracting considerable attention in artistic circles in London is a mechanical sculptor. It has been brought over from Italy by its present owners, Mr. W. G. Jones, a sculptor, and Sir A. Conan Doyle of literary fame. It is after the style of the pantograph, and by its means a statue can be triplicated in a day, each copy being an exact replica of the original.

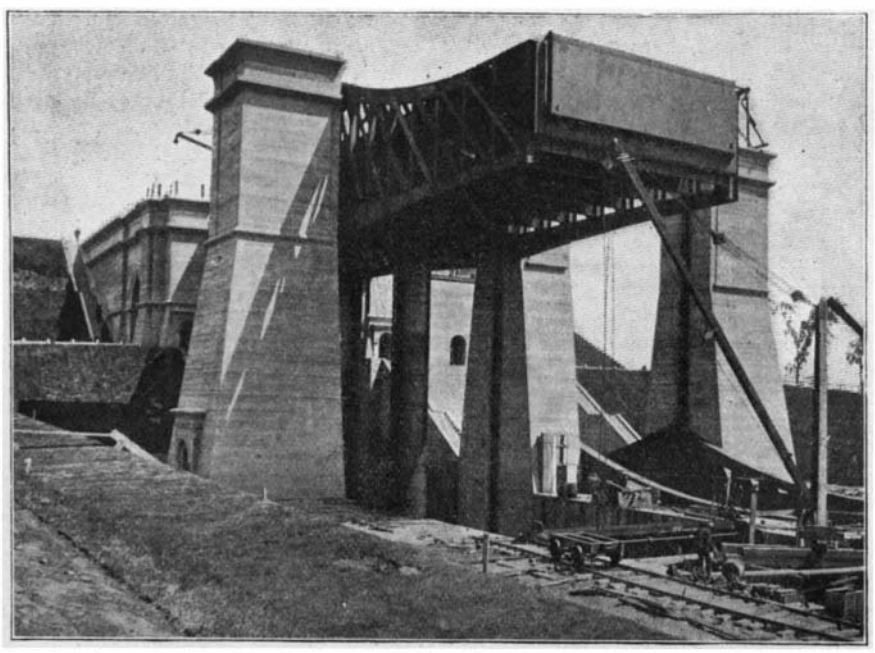
The machine, though somewhat large and cumbersome in appearance, is simple in construction, easily driven and manipulated. Briefly, it consists of two revolving drills, which are made to pass over the marble, and in this way fashion it according to the selected design. These drills work in sympathy with a dummy pointer. They are driven by belts connected with an overhead shaft driven by a one and a half horsepower engine. There is no reason why the machine should not be operated by electricity, or, in fact, any other motive power. During the last two months the apparatus has been at work in a shed near the Albert Suspension Bridge, Battersea, London.

When the writer visited the shed, two busts of Homer were being sculptured. It is essential, of course, for the machine to be supplied with a model. This is bolted to a frame, but so devised that it can be made to turn in any direction, according to the will of the operator. Two blocks of marble are then inserted in the frame, which move in sympathy with the model. Opposite the latter there is a seat, upon which the operator sits and from which he guides the dummy pointer which he passes over the model. Simultaneously with the moving pointer, the two revolving drills or cutters are made to follow a corresponding course over the blocks of marble. They chip the marble away like cheese. To keep the cutters cool a jet of water is thrown upon them, and as they grind into the marble and powder it to dust, it runs down as white as milk in a trough.

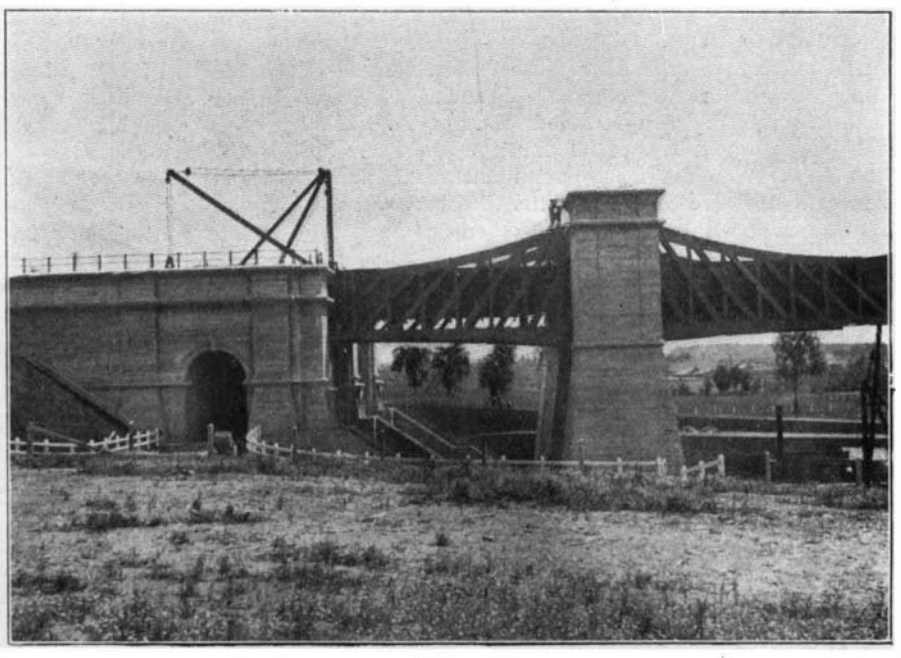
Every nook and cranny, every wrinkle or dimple, in the model can thus be repeated in the marble. The machine-made busts are nothing less than a perfect duplicate of the model. Mistake in the way of removing too much of the marble is impossible, as the tools operating on the blocks must work in perfect sympathy with the pointer, which, of course, cannot go below the surface. The pointer is of wood and stationary. The drills are of steel, and are made to revolve at a fairly high speed. For the more delicate work finer drills are used.

The apparatus, which covers about four square yards of ground, is valued by its owners at $2,500. As a labor-saving device it has undoubtedly much to commend it. At present, when a sculptor has completed his clay model of a statue which is eventually to be seen in marble, he hands it over to a man known as the "pointer," who by the aid of an instrument of that name drills hundreds of tiny holes of various depths in the block of marble which is to be carved into an exact resemblance of the clay model. As many as 1,500 of these small holes are often bored for carving one bust. When all the holes have been drilled, a man comes along with a chisel, and it is his laborious task to chip away the marble, guided by the depth of the holes. When he has finished, the sculptor puts in a few touches, and the bust or statue is complete. An ordinary bust—that is to say, one standing 2 feet 6 inches in height—takes at least six weeks to finish.

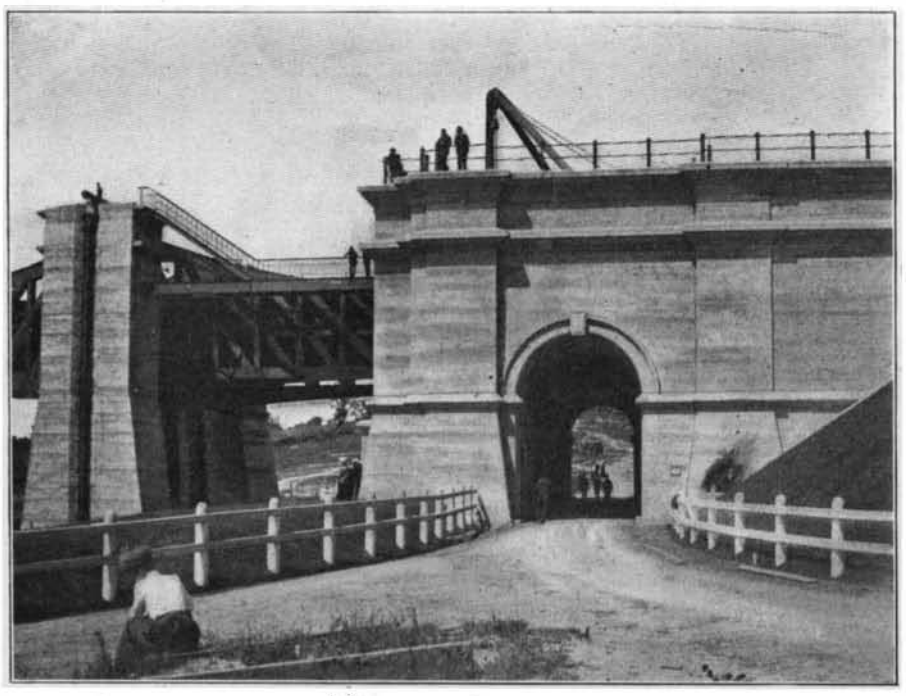
The invention under notice is capable of turning out two such busts in a single day of seven or eight hours. As the machine can be operated at very small cost, machine-made statues should become very popular among those unable to pay a fancy price for the hand-made article. It is but fair to point out, however, that only the mechanical side of sculptural art is affected by this invention. The machine is, in fact, merely a slavish reproducer of models previously prepared. Designs from our greatest sculptors can. a hundred times over, be executed in facsimile with amazing rapidity. The work, too, is done well. After



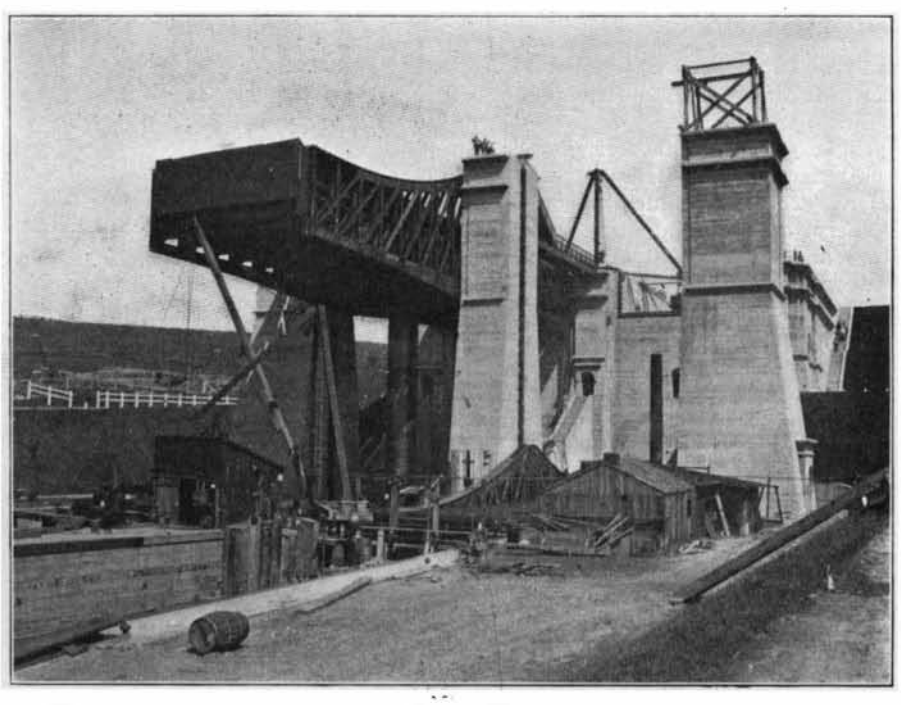
Peterboro Lock in Course of Construction.



A General View of One of the Peterboro Locks.



The Abutment of the Peterboro Locks, and the Public Driveway Passing Through.



One of the Locks, Showing the Cantilever Truss and the Great Hydraulic Ram.

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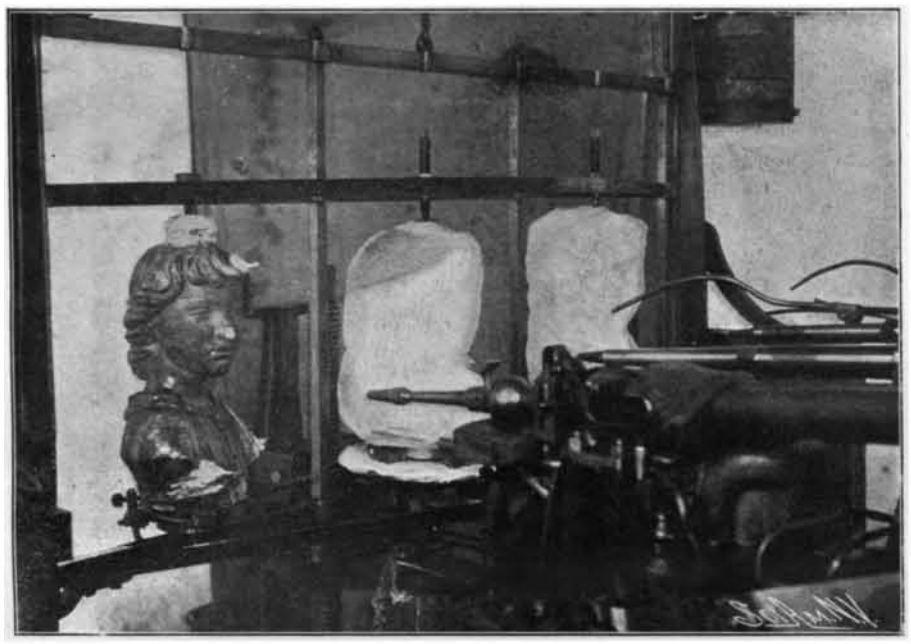
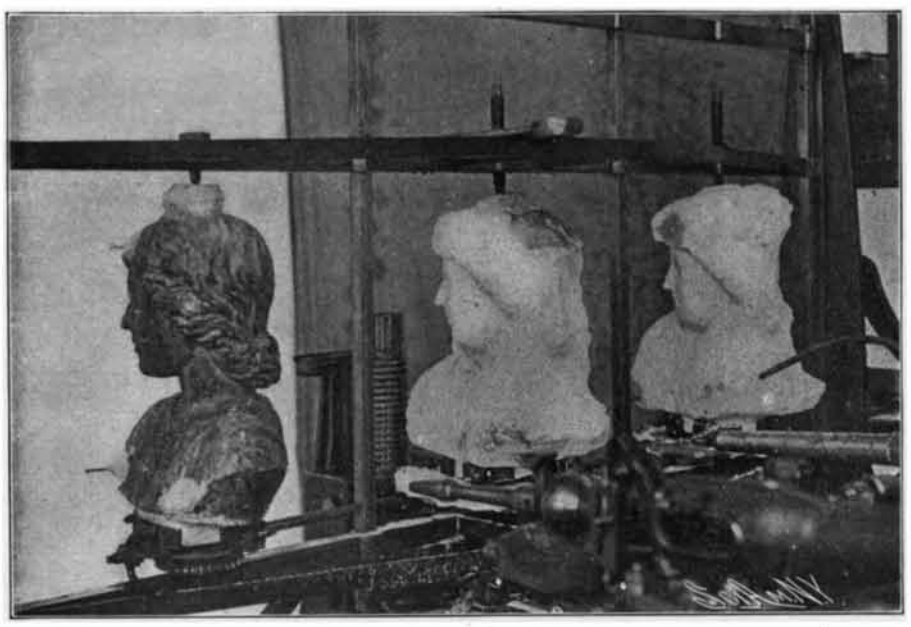


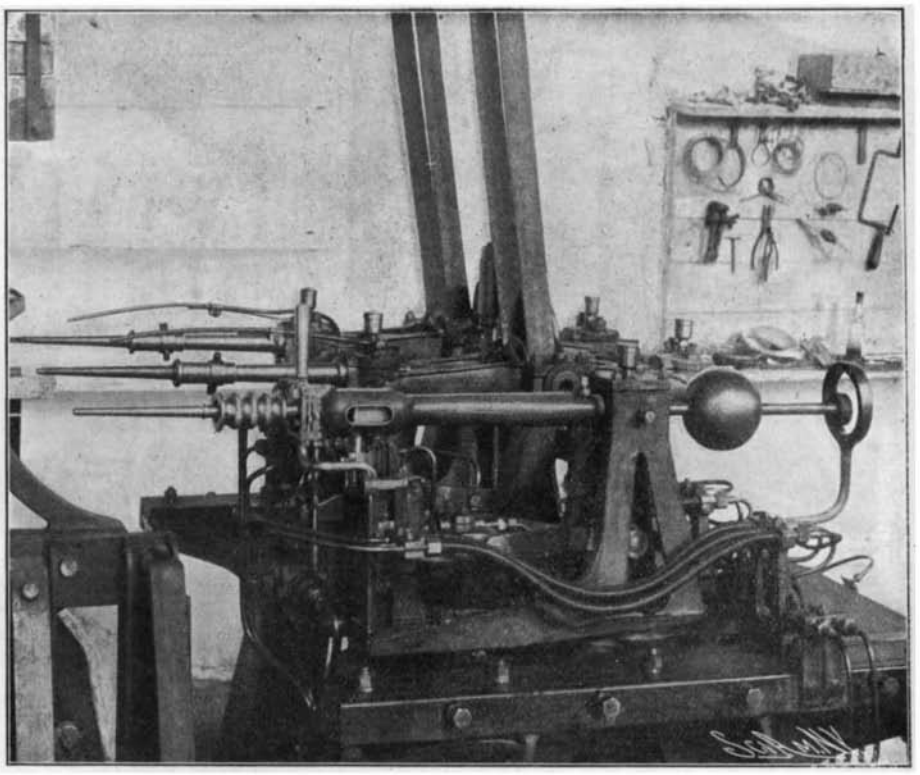
At the Beginning of Work.

After Thirty Minutes' Work.

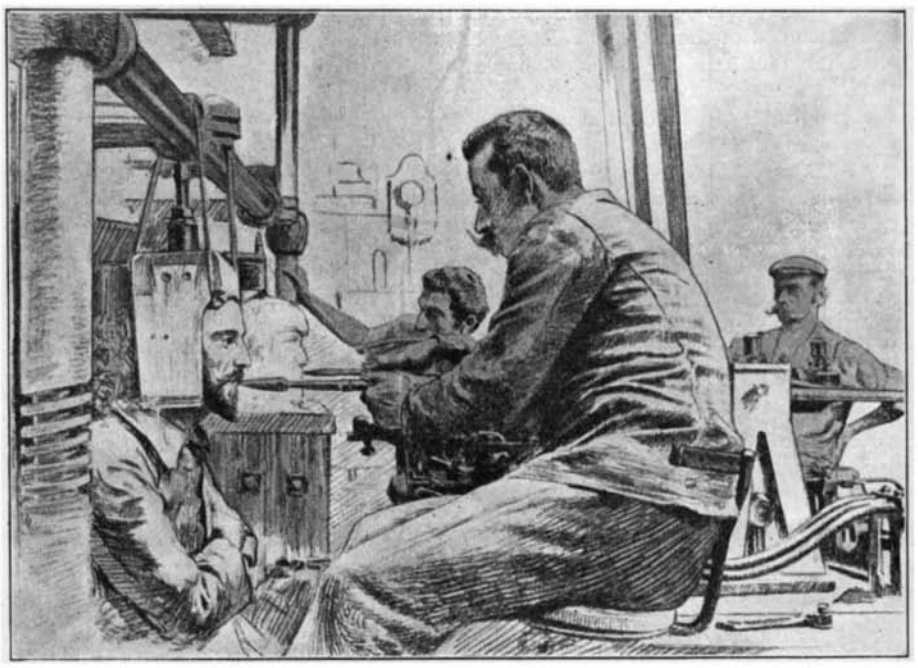


After Three Hours' Work.

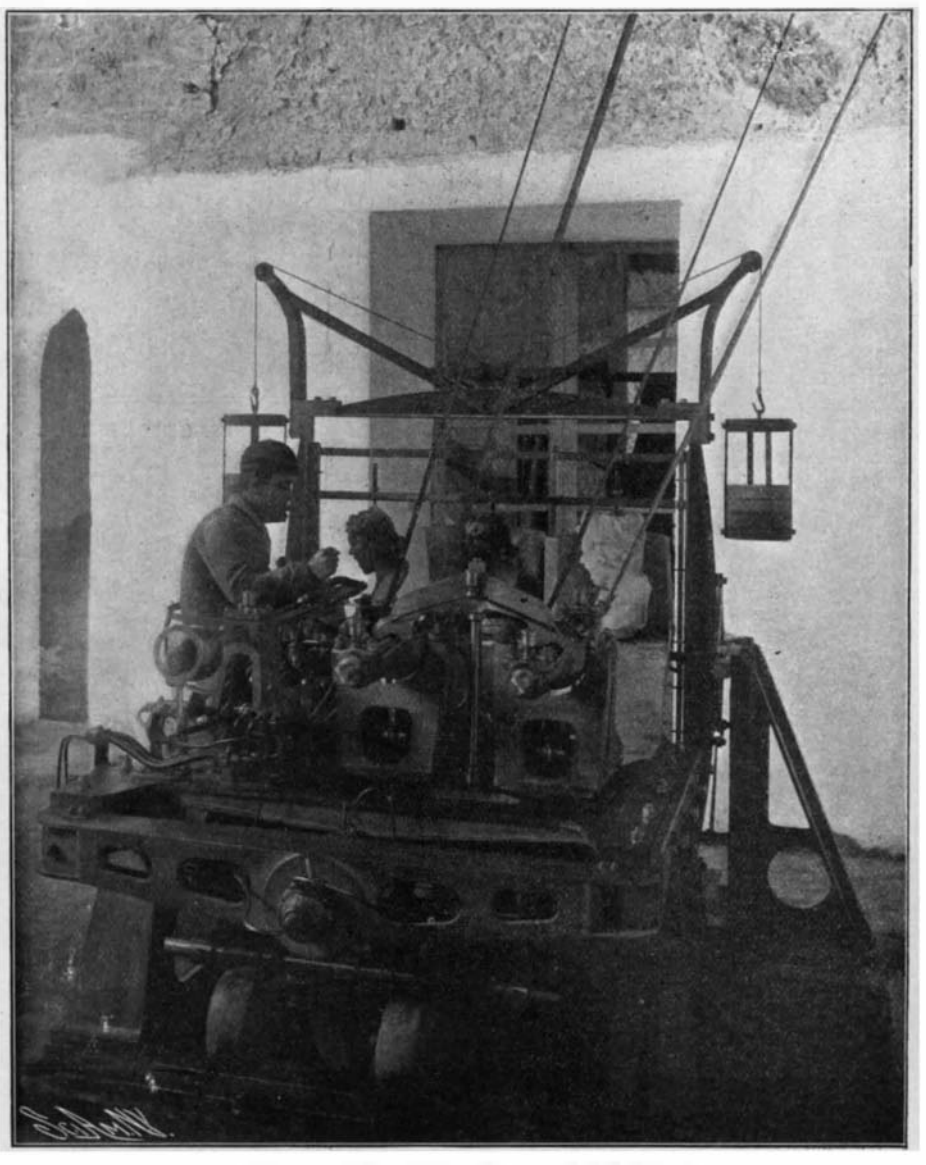
After Seven Hours' Work.



The Three Drills of the Machine.



Carving Directly from the Living Model.



A General View of the Sculpturing Machine.

AN INGENIOUS MULTIPLE SCULPTURING MACHINE.

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a bust has been machined, as it were, it is rubbed over with sandpaper, when it is ready for the market. For architectural display on buildings this additional labor would not be necessary.

Engineers who have inspected the machine declare that the principle can be adapted for wood-carving and chasing silver. Indeed, the owners have already been approached by a well-known London firm of silversmiths, for permission to build an experimental apparatus for silver work on similar lines. The machine is the invention of an Italian ex-naval officer, Signor Bontempi. Receiving much opposition from the Italian studios, he sold the patents to a society, formed of a few foreign and a few Italian gentlemen. They took premises in the vaults of the famous old ruin, the Palace Donn' Anna, at the foot of Posilipo, and set the machine at work. The first statue made was a copy of a Venus in the Naples Museum, which he did so well that the only means of distinguishing it from the model was its whiteness, the original being quite dark. Our illustrations were made directly from photographs, with the exception of one which is a drawing reproduced from the London Illustrated News.

Platinum in Southern Oregon.

BY DENNIS H. STOVALL.

This past year the discovery was made that there is much platinum as well as virgin gold in the old channel placer deposits of southern Oregon. Furthermore, the discovery has been made that the platinum can be mined at the same time the gold is mined, and with no additional expense. The platinum of these old channels occurs with the black sand, and is in fact a refractory article, a concentrate, carrying platinum in the free state and gold in a sulphide composition. For years this black sand has been known to exist in the old channel placer beds of southern Oregon, but the miners were ignorant of its identity and value, as well as of any method of saving it, and have allowed it to be carried off over the dump with the waste water.

Through the efforts of the Welsbach Company, of Philadelphia, or their representatives, a method has been devised whereby the platinum of these old channels can be saved. This company experimented for a number of months in the southern Oregon placer fields, and at last hit upon a system that is proving a success. This method of catching and saving the platinum consists simply in adding to the sluice-boxes a system of undercurrents and screens. The screens are of steel, and have one-eighth inch openings. The black sand, or concentrates, are drawn down through these screens, which are placed on the bottom of the sluices, and are then spread out over a broad riffle table, where they settle and are scooped up, ready for the refinery. The placer mines that have installed this system of undercurrents for saving the platinum sands find it a valuable addition of revenue to their regular receipts.

The platinum sand of the southern Oregon old channels is a black, granulated stuff resembling coarse black powder. The small particles of platinum can be easily detected by a close scrutiny, as they have a slight metallic luster. A few platinum nuggets the size of coffee grains have been found, but these are rare. As a number of placer mines are preparing to mine platinum next year, it is likely that the production of this metal will become an important part of the mining industry of Oregon.

Origin of the Grain Weight.

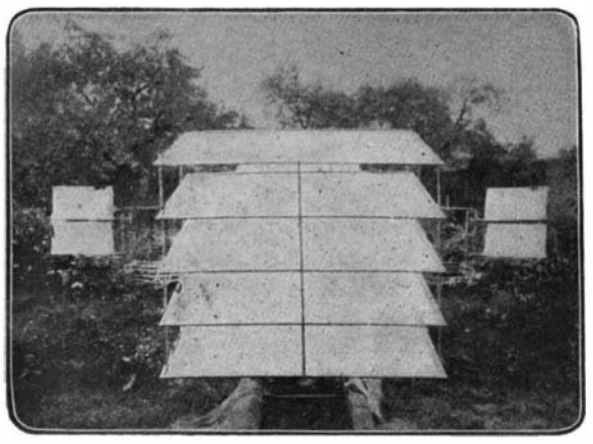
The Druggists Circular and Chemical Gazette publishes the following interesting note on the origin of the grain weight: By an English law passed in 1266, it was provided that a silver penny, called a sterling, should equal in weight 32 wheat grains, well dried, and taken from the center of the ear. From this it seems evident that the grain of wheat was the prototype of the standard grain. The weight now known as the grain is of course copied from governmental standards. In 1826 certain weights and measures were legalized in England, and in 1827 copies of these were furnished our government, among them being the troy pound, equivalent to 5,760 grains.

The origin of the signs commonly used for the scruple, drachm, and ounce does not seem to be known. It is not unlikely that they are entirely arbitrary.

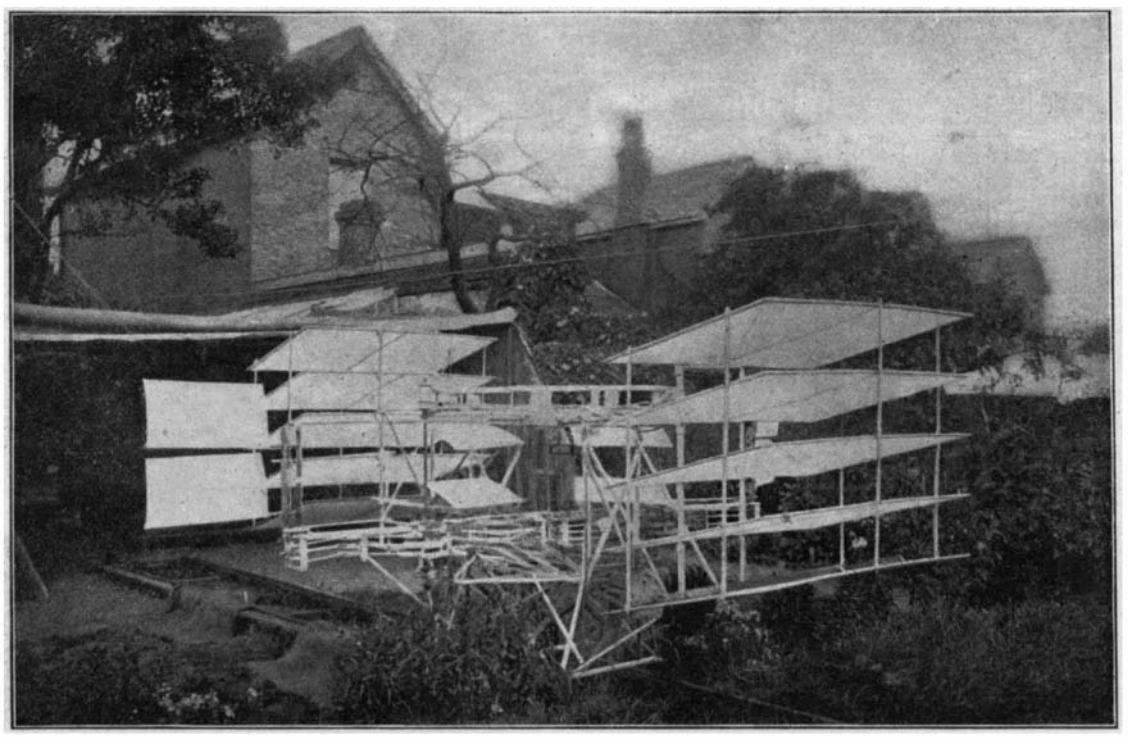
A NEW AEROPLANE.

Among the many inventions relating to aerial navigation, that of Messrs. Groombridge and South, which we illustrate herewith, is worthy of consideration, from the somewhat original design of the air propellers with which it is fitted. The accompanying photographs are those of a full-sized model which has been built by the inventor, and it will be seen that the machine itself, which is about 80 feet in length and 60 feet in width, is to be supported upon superposed aeroplanes which are attached to the framework both at the front and rear of the machine, while the propellers, which are six in number, are carried three on either side of the framework. There is also an extra one, not shown in the photograph, surmounting the whole structure.

The framework of the model is necessarily rather heavy, being constructed of wood, but in the actual finished ship a very much lighter construction would be used. The propellers are carried upon arms extending outside from the main or central driving shaft which forms an axis within a rectangle, the two vertical sides of which form axes carrying the vanes. During the driving stroke these vanes extend outside beyond the rectangle, while they return edgewise, or in a feathering position, inside it. To make this clearer, it must be understood that during the propelling stroke the vanes become strained backward against the resistance of springs, and as the vanes yield to the air, the latter remains practically normal and becomes an inert or solid fulcrum against which the vanes press, so that, when driving, they are in a vertical position, while at the completion of each stroke they automatically feather. Furthermore, the main central shaft is provided with two sets of vanes, so that one side may be propelling while the other is feathering, keeping the propulsion continuous.



END VIEW OF THE AEROPLANE.



MESSRS. GROOMBRIDGE AND SOUTH'S NEW AEROPLANE.

There is no doubt that this new form of propeller is capable of transmitting very considerable power, and the work in connection with the controlling mechanism is now so advanced that it only remains for a properly-constructed ship to be made, fitted with two 20 horsepower internal combustion engines, for a practical trial to be attempted. It must be mentioned that this airship is to be provided with four road wheels in order that it may attain a certain speed along the ground before the aeroplanes are put into action. It is estimated that when this speed has reached about twenty miles an hour the lifting power will then be sufficient to take the aerial navigator off the ground. The experiments with the new aeroplane will be followed with interest, and it is to be hoped that the machine will prove useful.—The Car.

Oil of Elæococca—A Natural Drying Oil Obtained in China.

A natural drying oil which is obtained in China and the surrounding countries is the oil of Elæococca. This oil is extracted from the fruit of the oil-tree (E. vernicia, cordata, or verucosa) which belongs to the Euphorbiaceæ. This tree grows in China, in the south of Japan and in Cochin-China. The oil is extracted from the fruit by pressing it when cold, and 100 parts of the fruit give about 40 parts of oil. When pressed hot the yield of oil is somewhat larger, about 50 per cent, but its composition is modified and it is strongly colored. This oil was imported into Europe for the first time in 1874. It was first studied by Cloëz, and after that by other chemists who determined its composition and examined its curious properties. It has a density of 0.940 at 15 deg. C., and its color is golden yellow. When freshly prepared it is inodorous, but after a time it gives off a characteristic odor which somewhat resembles that of castor oil of an inferior grade. Its freezing point depends upon whether it has been freshly prepared or not, and varies according to circumstances from —3 to —20 deg. C. It is soluble in the usual solvents for fatty substances, except alcohol, which must be boiling to dissolve it. The oil has 72 per cent of fatty acids and it can be completely saponified. Below 18 deg. C. it is very clear and limpid, but above that temperature it tends to thicken without losing its transparence. One of its curious properties is that of solidifying when heated to 200 deg. C. It then assumes a jelly-like appearance. This phenomenon is due to an absorption of oxygen from the air. On the contrary, when this temperature has not been reached and when the oil is heated for some time at 180 deg., it loses the property of solidifying at 200 deg., as its chemical constitution is absolutely modified.

The most useful property of the oil is that it is a natural drier, and this property is strongly marked. It is due to the absorption of oxygen from the air. This oil is a better drier than all others known, and when spread upon a polished surface such as glass it quickly solidifies in the form of a colorless film. When placed in a sealed glass tube and exposed to sunlight it is transformed into a solid mass whose melting point is 32 deg. C. The oil is a highly refracting body and it seems that the shorter wave lengths act to cause the transformation. In China and Japan it has been used for a long time past to cover the wood which is used for boat-building and like purposes. A fine varnish is made with it which dries quickly and has a brilliant luster. The French consul at Canton states that it enters into the composition of Chinese lacquer. Besides its use for varnishes, it is also employed for waterproofing different fabrics. In Europe it has often been substituted for linseed oil for obtaining certain varnishes. When treated by litharge and then dissolved in turpentine, an excellent varnish is obtained which is quite transparent, and this without the addition of resin. As linseed oil is generally of a dark color it is difficult to prepare light colors or varnishes with it, and therefore the use of this oil is to be recommended. In China, Japan, and Cochin-China, the annual production is about 2,800 tons. It is exported to Germany, America, and England, but it is only since 1896 that it commenced to be exported in considerable quantities. In 1897 the exportation to the three countries mentioned above was about 70 tons.

W. Ackroyd has found that radium bromide induces phosphorescence in common salt at ordinary temperatures. The phenomenon may be observed as follows: A wooden match box is filled with table salt removed from the inner portion of a block; a tube of radium bromide is pressed into the yielding mass and just covered with the substance. If it be now put on one side for a few hours, say into one of the compartments of a chest of drawers, on opening the box in the dark the tube will be found to phosphoresce all round with a white light, but, unlike zinc blende and barium platinocyanide, the salt continues visibly to phosphoresce after removal of the radium bromide. The portions of salt round the tube are turned of a faint buff or ocher tint. The image of the visible portion round and where the radium bromide tube has lain is impressed on a photographic plate in thirty minutes.—Nature.

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INDIAN GRANARIES.

BY CHARLES F. HOLDER.

The traveler in the western country, especially that region beginning with New Mexico and Arizona, will, if interested in the comparison of Indian types, notice how far ahead the western Indians are of their eastern brothers in the art sense. This cannot be better shown than in comparing the basket work of the Pacific and Atlantic slope Indians. That of the former is artistic in every sense—shape, tone, and color; indeed, it cannot be improved upon, as shown by the remarkable fad developed among Americans for making Indian baskets, competing, in fact, with these unfortunates, who are rapidly being exterminated before the white invasion of their land and territory. The basketry of the Atlantic coast, so far as art is concerned has nothing to commend it, the work of the New England Indians, as an example, and that of the Tulare Indians, of California, being as different as native jewelry and that produced by the finest workers.

The art sense of the western basket makers extends to other objects made of grass or plants, and is particularly conspicuous in their so-called "sequin," or granary, which, while crude, is essentially artistic and attractive. In the West, particularly Arizona and New Mexico, the natives are grain raisers; and that they were past masters in irrigation and agriculture is known to any one who has made an examination of the Southwest, where their story is told to the observant traveler. These people raised grain and made especial provision for storing it, and in many of the cavate lodges, especially in the Verde Valley. according to Mindeleff, are found strange cysts doubtless intended for grain. The largest are five feet across; many are smaller and level with the floor. Cushing tells us that the Zunis placed their grain in crevices in the rocks, which were often sealed up. He saw in the caves of Las Tusas in Arizona and among the Havasupai Indians grain caves which had been carefully plastered up with selected rocks. He says: "Later, while still the houses continued to be mere low-walled and partitioned sheds or huts of dry masonry, these granaries came to be quite well constructed of mud-laid walls, and were enlarged, as stores increased with increase of settlement and tillage, until they had to be built outward from the niches like good-sized, slightly tapering bins, protruding somewhat from the cave walls, and finally forming, as do the granaries of the Tarahumári to-day, miniature prototypes of the perfected single cliff house of a far later day. In times of great danger small children were not infrequently bestowed for safe-keeping in the larger of these little granary rooms in the deepest recesses of and at the rear of the earliest cave villages, as the finding of these remains without burial-token in such situation has attested; and thus the folk-tales which modern Pueblos tell of children left in the granary rooms and surviving the destruction or flight of their captive elders by subsisting on the scant store remaining therein (later to emerge—so the stories run—as great warrior magicians and deliver their captive elders), are not wholly without foundation in the ancient past of their ancestry."

Fig. 1.—Chemehuevi Indian in His House, Watching the Cornfield.

The Chemehuevi of to-day, when he plants his corn, watches it with the greatest care. Sometimes he builds a scarecrow. One observed by the writer was a laughable imitation of a Moqui, but the birds it was designed to frighten were everywhere in the vicinity. The first-mentioned Indians often build a sort of rustic couch which is topped with a fantastic bower, and in this, at his ease, the native farmer tends his growing grain. This resting place for a field siesta is very ingeniously made. The lower portion is formed of two logs laid parallel, about seven feet apart; over this are placed limbs of mesquite or willow for slats. Four corner posts are inserted and outside slats fastened to them with string or willow. The builder then cuts young willows fifteen feet or so in length fro the neighboring river bottoms and inserts them into the sandy ground, at head and foot, interlacing them at the top, where they form a perfect canopy from the hot sun. On the windward side he piles up other willow branches, and throwing over the couch part others, has a comfortable resting place on the edge of his grain field, from which vantage ground he can watch the various enemies, feathered and otherwise, that infest the country. In the accompanying illustration the Indian is seen enjoying a siesta.

When the grain is all in it is stowed, in the case of the Chemehuevi, in an artistic granary (Fig. 2) resembling somewhat a gigantic beehive. A framework or platform is made, about two feet in height, on which a great cheesebox-like basket is built, several feet in diameter and as many in height. This is constructed also of willow, in some instances wound about and interlaced to form a rude basket, as shown. The Yuma Indians often have the granary on top of the house, as shown in Fig. 3, which is in itself a picturesque structure, the granary resembling a chimney. The house is a large parallelogram, the four corner posts and the frame the same, the sides being formed of willow or some other brush with the leaves left on, which is placed upright and interwoven and held in place by four or five cross-pieces. The door in this instance is a crude arrangement covering about two-thirds of the opening, so that the establishment is well ventilated. In summer no shelter is needed in this hot country, almost every one sleeping out-of-doors. In a trip made by the writer through Arizona and New Mexico in August it was interesting to note how universal this was. Wherever there was a hotel, as at Indio, two or three hundred feet below the level of the sea, beds were seen on the verandas, and on the open desert groups of Indians would be seen lying out without covering. In one place two or three miles from an apology of a town a cot-bed was seen in the open and nothing else—the "home" perhaps of some herder. In a little Mexican settlement a one-roomed adobe bore the title "Hotel." The hotel contained but one room—the bar—the sleeping quarters being a large corral in which, under the blue sky, were a dozen or more cots. The writer entered this town about five o'clock in the morning, and each bedroom of this unique hostelry was occupied by a sleeping patron—a laughable spectacle even to one well accustomed to western life, and amazing to the genus tenderfoot. The fence about the corral insured the occupants against wandering burros and pigs. In July and August in this region no other life would be endurable, and any one who has experienced the charm of sleeping out-of-doors in Arizona and New Mexico would not, in all probability, exchange it for other methods, at least in the locality mentioned.

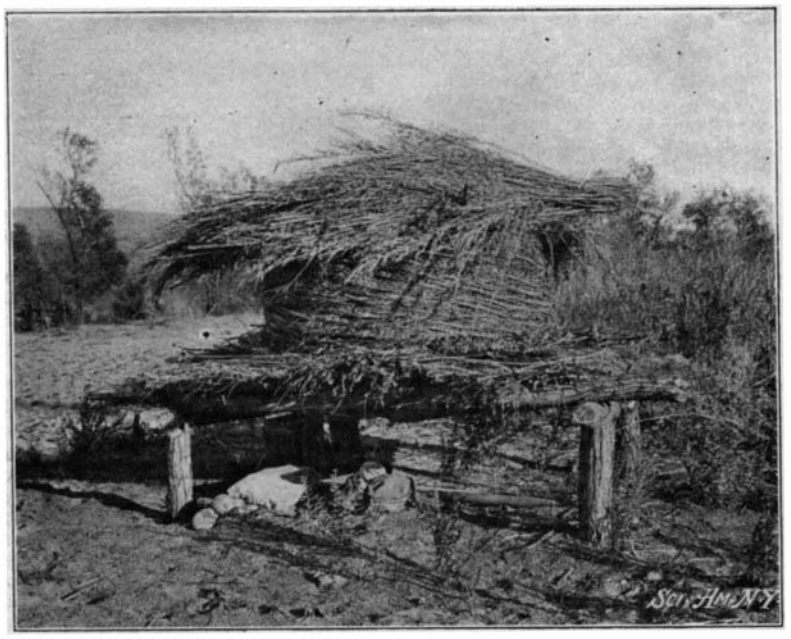

Fig. 2.—Chemehuevi Granary.

Some of the Arizona Indians have very attractive granaries of basket work. Three such are owned in Pasadena, and one would hold three adults readily. These baskets for grain are beautifully made, and when the rage for Indian basket collecting began, they were bought up for large sums, bringing from one to two hundred dollars, and the singular sight is witnessed of an Indian granary in a modern American dwelling now included among the objects of art.

An investigation of the wood of Xanthoxylon Scandens has been made in the laboratory of pharmaceutical chemistry at the University of Utrecht by A. van der Haar. The wood, under the name of Arenybé-régédég, is used as a fish poison. It appears to contain an alkaloid, the hydrochloride of which is crystalline; one or more acids soluble in acetone and ammonium carbonate, but insoluble in water; one or more acids soluble in acetone and sodium carbonate, but insoluble in water; and one or more acids soluble in water and in alkalies, but insoluble in acetone. The bark contains also a higher aliphatic alcohol with a melting-point of 60 deg., and an acetate with a melting point of 40 deg. C.

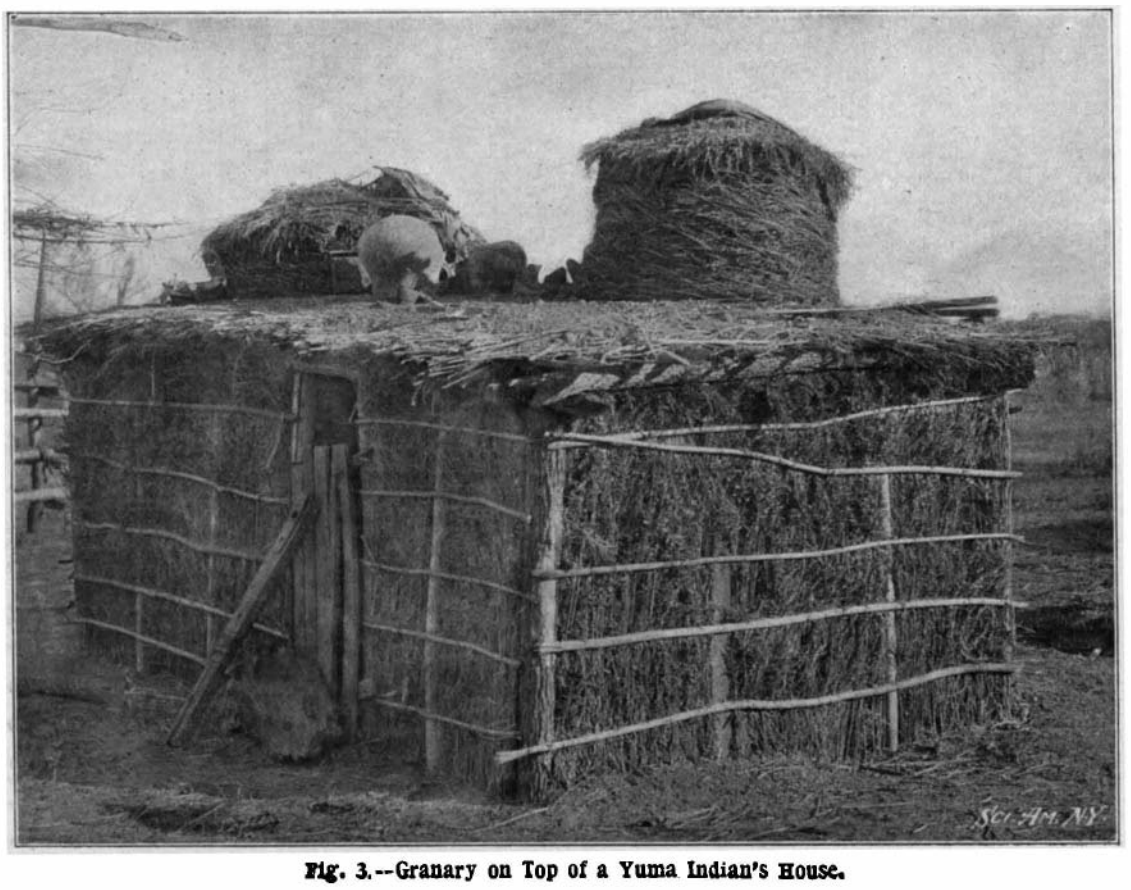

Fig. 3.—Granary on Top of a Yuma Indian's House.

INDIAN GRANARIES.

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RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

DENTAL SPRAYING APPARATUS.—J. C. HOLSON, Ord, Neb. In this patent the invention relates to a valvular nozzle adapted to be connected to a hose or other source of water-supply. The present improvements lie in a special construction of nozzle-body and in the peculiar arrangement therewith of a valve to be controlled at will by the person manipulating the nozzle.

PORTABLE OXYGEN-GENERATING APPARATUS.—A. ROSENBERG, 21 Southampton Row, London, England. The object in this case is to prevent loss of heat and avoid the consequent delay in starting military signaling operations and the like or the interruption of the gas-generating operation, particularly when carried on in wind or rain exposure, also to enable the operation to proceed continuously and the gas to be at the same time used without the employment of more than one gas-holding bag, and, further, to enable all the requisites for the generation of, say, forty cubic feet of oxygen to be quickly packed in a small box for transport.

Electrical Devices.

SWITCHBOARD FOR TELEPHONES.—G. F. ARCHER, New York, N. Y. Mr. Archer's invention covers a form of so-called "intercommunicating system," in which any subscriber may call any other subscriber by merely pressing a button. Each subscriber is furnished with a small switchboard having a number of push buttons commensurate with the number of stations connected with the line. A single push of a button serves to disconnect from one subscriber and to connect with another. While such systems have been used heretofore, this invention contains many ingenious points.

SUPPORT FOR ELECTRIC FIXTURES.—C. A. HANNAN, New York, N. Y. The present invention relates to improvements in supports for electric fixtures, the same being essentially adapted to carry and support an electrolier from the electric conduit system of a building in a rigid and substantial manner, the improvement tending to materially simplify the existing methods of installation and permitting a better mechanical construction to be secured at a considerable saving in cost.

Engineering Improvements.

DEEP-WELL PROPELLER-PUMP.—J. M. TILLOTSON, Kinder, La. The invention consists in a deep-well propeller-pump having loose boxings with arms or wings which are smaller than the well-bore and do not touch the sides of the bore except as the shaft may sway or vibrate, and a propeller of a diameter somewhat less than that of the boxing arms, so that in any lateral movement of the shaft the arms of the loose boxing act as fenders against the sides of the well to strike the well and prevent the propeller from coming in contact with the walls, the shaft being freely suspended in the well from its upper end.

STEAM-TRAP.—J. G. MORGAN and W. BLETSO, Youngstown, Ohio. The purpose of the inventors in this patent is to provide a new and improved steam-trap which is simple and durable in construction, very effective in operation, completely balanced, and arranged to insure a proper working of the trap and discharge of the water of condensation under any pressure of the steam entering the trap.

Machines and Mechanical Devices.

CAPPING-BLOCK.—C. C. MCDONALD, Elyria, G. L. BROWN, Lorain, and W. H. TEARE, Cleveland, Ohio. The improvement consists in a block adapted to have one or more cans fitted thereto and so constructed that cans of different sizes may be engaged with the block in one position or another and that when so engaged the smaller cans will be raised to the height of the largest can to which the machine is adapted. The small can thus elevated may be passed through the machine adapted for the large can and the cap applied thereto without altering the machine itself.

GREASE-FEEDER.—C. T. PREHN, Ludington, Mich. In the present case the invention has reference to a device for feeding a grease or other lubricant to an engine, the feeding means being operated from and in time with the movement of the engine, so that the feed of lubricant is proportionate to the speed of the engine.

SORTING-MACHINE.—H. SPEISER, 51bis Avenue de la Republique, Paris, France. Mr. Speiser's invention relates to a machine for sorting articles according to their size, and the improvement consists, essentially, in charging the articles to be sorted onto conveyers passing through a series of fixed openings, which become narrower, in combination with ejectors so operated as to throw out the articles left by the conveyers on the edges of the openings.

DEVICE FOR TRANSMITTING MOTION.—G. G. BEITZEL, 23 Norrebrogade, Copenhagen, Denmark. The present invention is an improvement over a former patent granted to Mr. Beitzel. The device covered by the older patent is essentially adaptable for use in sewing-machines. In that mechanism the distance between the table-slab and the lowermost point of the mechanism is too great and the driving-shaft is too far from the slab. Consequently difficulties arise tending to interfere with perfect action when it is desired to actuate the carrier directly from an eccentric disk mounted upon the driving-shaft. The purpose of the present device is to remedy these difficulties.

Of Interest to Farmers.

REAR-WHEEL CONTROLLER FOR DISK PLOWS.—C. J. SIMERAL and F. A. WIGGINS, Salem, Ore. The aim of this invention is to provide a new and improved rear-wheel controller for disk plows arranged to hold the rear wheel at all times firmly in the desired position, especially when plowing on hillsides or under any condition tending to swing the plow out of line, thereby preventing variation in the width of the furrows.

SEED-SOWER.—W. H. BOHR, Westphalia, Mich. It is the object of this invention which relates to improvements in hand seed-sowers, to provide a simple, compact, and cheap article which may easily be carried on the person and manipulated or controlled with facility, so as to distribute small seeds, such as clover-seed and grass seed. Means are provided for indicating the rate of discharge.

Miscellaneous.

SCENIC APPARATUS.—F. W. THOMPSON, New York, N. Y. Mr. Thompson's invention relates to improvements in scenic apparatus, the object being to provide a device of this character so arranged as to give persons the impression of sailing in a submarine vessel from one point to another and then back to the starting point.

GARMENT-FORM.—W. F. PALMENBERG, New York, N. Y. The invention provides an improved garment form arranged to enable the garment fitter to readily obtain correct front and rear center lines of the dress and the exact distance from the waist line to the scye to insure accurate fitting of the garment.

CARPET-STRETCHER.—W. F. KALLBERG, Stillwater, Minn. An extremely simple and novel device for stretching and holding carpets until they may be secured by tacks has been provided by this invention. The use of sharp projections such as prongs into the fabric is entirely obviated. A clamping-plate is used instead.

SEAL-LOCK.—C. W. MCSHANE, Zaneseville, Ohio. One of the principal objects of the invention is to provide a device which shall constitute a combined lock and seal so that when applied to a corridor it shall be impossible to open the door without the same being detected owing to the breaking or destroying of the seal.

SHOE ATTACHMENT.—J. N. SCISM, Schenectady, N. Y. The purpose of this invention is to furnish a shoe attachment which will not only serve as a permanently-secured shoe-horn, forming virtually a part of the shoe, but also as a lining for the shoe at the heel and quarters thereof. The improvement is particularly adapted to low-cut or oxford shoes, although it could be used on shoes of other forms.

ADVERTISING-SIGN.—J. S. ANDERSON, New York, N. Y. The invention has reference to improvements in advertising-signs, the object being the provision of a device of this character of simple construction and operated by a suitable motor to display at intervals various advertising matter. The matter may be illuminated by electric lamps, arranged in the casing, but this feature may be omitted without departing from the spirit of the invention.

EXHIBITING-BOX.—MARY E. FRANCISCO and J. F. MARTIN, San Diego, Cal. The invention in the present patent is an improvement in boxes, and especially in exhibiting-boxes designed for use in holding dates and other articles of merchandise which it may be desired to protect and to which access may be conveniently had from time to time.

BELT-BUCKLE.—J. L. BROWER, New York, N. Y. The purpose of this invention is to provide a new and improved belt-buckle more especially designed for use on ladies' belts and arranged to allow convenient adjustment for properly fitting the waist of the wearer and to permit of giving any desired dip to the front of the belt.

BUILDING CONSTRUCTION.—F. W. SPENCER, Albuquerque, New Mex. The invention refers to certain improvements in the construction of building walls or the like, and has particular application to a novel form of building-block. In carrying out his invention Mr. Spencer has in view the laying of his improved blocks in such a manner that a series of isolated air-cells will be formed in the walls, confining the inclosed air in a small space or chamber. The block may be laid with ease and facility.

SCARF-RETAINER.—R. L. GOODING, Bridgetown, Island of Barbadoes, British West Indies. In this case the invention relates to wearing-apparel; and its object is to provide a new and improved scarf retainer or clip which is simple and durable in construction, easily applied, and arranged to securely hold the depending portions of the scarf or other tie securely in place on the shirt-bosom.

BUTTONHOLE-CUTTING ATTACHMENT FOR SCISSORS OR SHEARS.—M. H. BOLSINGER, Windber, Pa. Mr. Bolsinger's invention relates to an improvement in scissors and shears, its object being to provide an attachment forming a part of an ordinary pair of scissors or shears, whereby they may be used for cutting buttonholes, as well as for ordinary purposes, and also for adjusting the same for cutting different sizes of buttonholes.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 4643.—Wanted. something practical to remove or prevent scale in boiler feeders.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 4644.—For makers of lava insulators for insulating spark plugs for gas engines.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 4645.—For makers of brushes of all kinds.

Mechanics' Tools and materials. Net price catalogue. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 4646.—For castings for a ½ h. p. gasoline motor, water cooled, also blue prints of same.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 4647.—For manufacturers of ball bearings.

Patent to sell, royalty or will take partner. Staple article. Hardware, Box 773, New York.

Inquiry No. 4648.—For manufacturers of metal selenium.

PATENT FOR SALE.—Double-action suction pump. D. Schurman, 330 Hudson Street, Hoboken, N. J.

Inquiry No. 4649.—For makers of snap buttons for gloves.

Our specialty is cutting and forming metal parts any shape. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 4650.—For a prospecting drill for use by hand weight about 300 pounds where adamantine is used.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 4651.—For manufacturers of corrugated rubber as used on stair treads.

Machinery designed and constructed. Gear cutting The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 4652.—For manufacturers of lathes for turning irregular shapes in wood.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 4653.—For makers of light oak tan leather.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 4654.—For manufacturers of block felt.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 4655.—For a second-hand steam engine ½ to 1 h. p., oil or gasoline fuel.

Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

Inquiry No. 4656.—For makers of carbonated water bottling machines.

WANTED SPECIALTY.—A thoroughly equipped machine shop wants specialty to make. We will do anything that anybody else will not do. Address P. O. Box 221, Wilmington, Del.

Inquiry No. 4657.—For manufacturers of automatic name plate machines.

PATENT FOR SALE.—Automatic horses. A 1 proposition St. Louis Exposition. See SCIENTIFIC AMERICAN, March 7, 1903. Working model. E. P. Thompson, 156 Fifth Avenue, City.

Inquiry No. 4658.—For makers of piano tuners' and repairers' tools, such as string lifter, regulating screw driver, felt picker, action tweezers, etc.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 4659.—For manufacturers of upright revolving swings.

WANTED.—New novelties that are ready for the market. Must possess merit to justify extensive advertising in this and Foreign Countries. *What have you?* Wizard Novelty Co., Inc., 1007 Filbert Street, Philadelphia.

Inquiry No. 4660.—For an accordion pleating machine.

Inquiry No. 4661.—For makers of auto wheel chairs propelled by gasoline or electricity, capacity of two persons.

Inquiry No. 4662.—For parties engaged in the development of electrical inventions.

Inquiry No. 4663.—For stems, holders or metallic attachments for large buttons.

Inquiry No. 4664.—For makers of family ice machines.

Inquiry No. 4665.—For a machine for making typewriter pen, pencil and stylus carbon paper.

Inquiry No. 4666.—For makers of freezing machines.

Inquiry No. 4667.—For a machine for cutting rags.

Inquiry No. 4668.—For makers of rotary machine brushes with steel bristles.

Inquiry No. 4669.—For makers of ice machinery, for making crystal ice in blocks.

Inquiry No. 4670.—For manufacturers of brick machinery.

Inquiry No. 4671.—For manufacturers of wood-working machinery for running an up-to-date cabinet shop.

Inquiry No. 4672.—For manufacturers of flexible shafting.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9201) F. K. asks: At what time between 4 and 5 o'clock are the hour and minute hands together? I had an argument with a friend about it. He says the hands will be together at 22 minutes after 4. I say at 27 2-3. A. The hour and minute hands of a clock are together at 21 mins. 49 1-11 secs. after 4 o'clock. This is the solution: The minute hand moves 12 hour spaces while the hour hand moves 1 space. The minute hand gains 11 spaces in one hour. At 4 o'clock the minute hand has 4 spaces to gain before overtaking the hour hand, and will require 4-11 of an hour to do this; for gaining 11 spaces in an hour, it gains 1 space in 1-11 of an hour and 4 spaces in 4-11 of an hour, or 21 mins. 49 1-11 secs. From this it is easy to see that the hands are together at 12, and every 1 1-11 hours after that time, or at 1 hr. 5 mins. 27 3-11 secs., etc.

(9202) E. A. S. asks: Why is it that the tone of a steam whistle on a locomotive which is rapidly approaching is of a higher pitch than when it is going from you? A. The rise of the pitch of the whistle of a locomotive which is approaching is in accordance with what is known as Doppler's principle, so named from the discoverer. It will be found in any of the advanced textbooks of physics, such as Ganot's, price $5. When the sounding body approaches the ear, more sound waves reach the ear in a second than if the body were at rest. More waves per second produce a higher pitch. If the sounding body were receding less waves per second would reach the ear, and therefore the pitch of the sound is made lower. There have been several experiments devised which demonstrate the fact and which are recited in the book referred to above.

(9203) F. H. B. says: In SCIENTIFIC AMERICAN of July 25, page 70, inquiry No. 9092, you state, "the most perfect *vacuum* attainable." What do you mean by that? In what part of the compound engines does the *vacuum* take place, and how many pounds to the square inch can the vacuum be attained? A. The exhaust steam of many engines is allowed to pass into a condenser, where it is condensed either by the direct action of cold water or by cold water passing through a large number of thin pipes which come in contact with the steam. The condensed steam and any air or other water which may have entered the condenser are then pumped from the condenser by means of a pump called an air pump. The condensing of the steam in this way in the condenser forms a partial vacuum there, and also in the exhaust pipe connecting with the condenser. The degree of this vacuum will depend upon the amount and temperature of the condensing water and on the efficiency of the air pump. A perfect vacuum corresponds to a pressure of about 14.7 pounds per square inch below that of the atmosphere, or about 30 inches of mercury. Many steam engines, in actual practice, attain a vacuum of about 26 or 27 inches of mercury, which corresponds to a pressure of about 13 pounds below the atmosphere. This vacuum very much increases the power of the low-pressure cylinder of a compound engine by removing the greater part of the pressure that otherwise would exist on the exhaust side of the piston—the work in the cylinder being equal to the difference in pressure on the two sides of the piston multiplied by the distance that the piston moves.

(9204) A. G. says: 1. What are the prospects of a young man entering the electrical field? 2. How and where can a young man, who is going to school, and studying in the evening, receive a position in an electrical concern? A. The prospects for a young man of ability who is thoroughly trained for the work are excellent in the electrical field, but it is unwise for one to attempt to enter this field, in which there are so many well-trained men, unless he has an adequate training to enable him to compete successfully. The only way which we can suggest to you for obtaining a position with an electrical concern is by writing, or direct personal application to the various companies in the line which you wish to enter, but unless you can show that you have had a training which will make you valuable to these concerns, the chances of your application's receiving notice are small.

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NEW BOOKS, ETC.

CLEAN MILK. By S. D. Belcher, M. D. With an Introduction by William Hallock Park, M. D. New York: The Hardy Publishing Company. 1903. Pp. 146.

In this compact little book, it has been the aim of the author to set forth practical methods for the exclusion of bacteria from milk. It includes a system of operations which has been successful in materially reducing the bacteria contamination of milk, from the moment it is drawn from the cow until it is used by the consumer. The work in the field which supplied the data for the book was performed under the grant for the Rockefeller Institute for Medical Research. It was carried out under the supervision of Dr. Park, and formed a part of the movement for the improvement of New York city's milk supply. The book is clearly and concisely written, profusely illustrated, and treats in a clear and convincing way of one of the most important questions affecting the health of the community. A copy of this book should be in the hands of every dairyman and milk dealer.

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September 29, 1903,

AND EACH BEARING THAT DATE.

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Building material, manufacture of artificial, A. Seigle 740,188
Building or roofing block or material, S. C. Davidson 740,099
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(Continued on page 266.)

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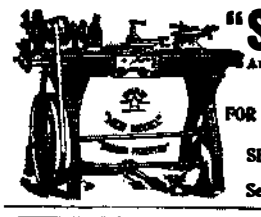

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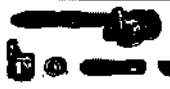

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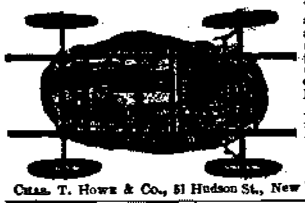

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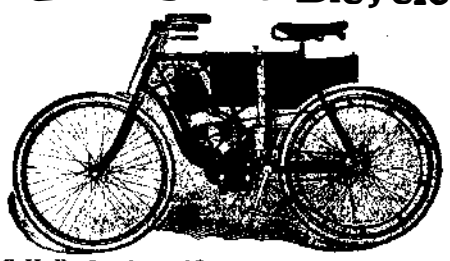

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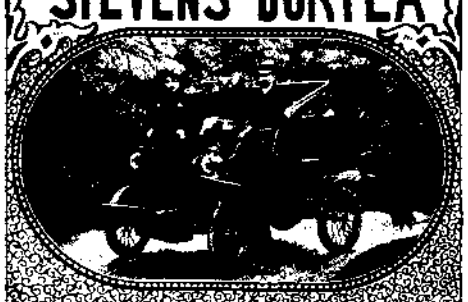

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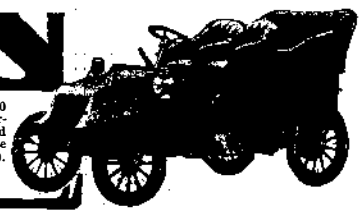

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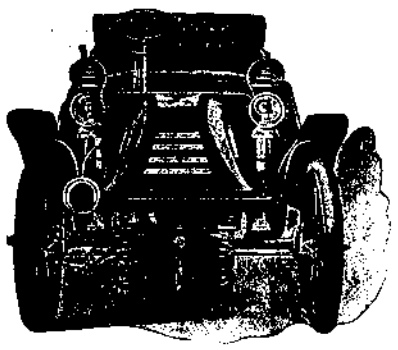

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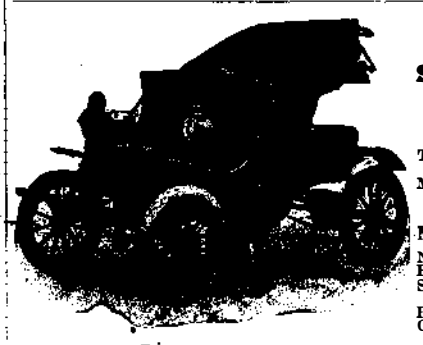

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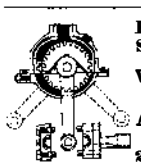

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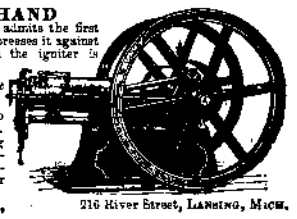

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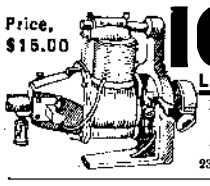

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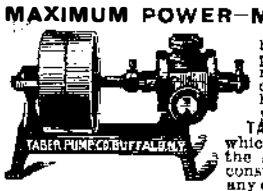

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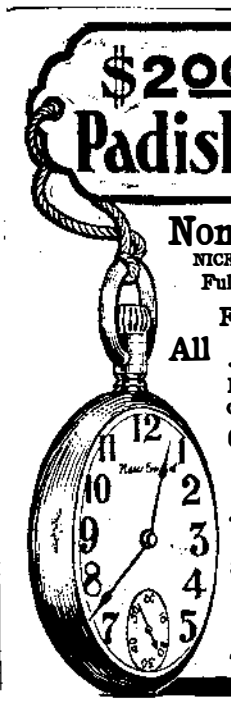

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